THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXII. No. 1596.] LONDON, DECEMBER 12, 1893. [45TH YEAR. PRICE 6d.

GAS AND WATER PIPES

1¼ to 12 IN. BORE.

THOMAS ALLAN & SONS,

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SOUTH STOCKTON-ON-TEES.

ALSO MANUFACTURERS OF
SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.

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NEW HIGH-POWER GAS-LIGHT.

INCANDESCENT GAS-LIGHT SYSTEM.

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3¾ cubic feet per hour.

Gives a light of
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Brilliant Light.

Perfectly Steady and
Noiseless.

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Reduced Heat.

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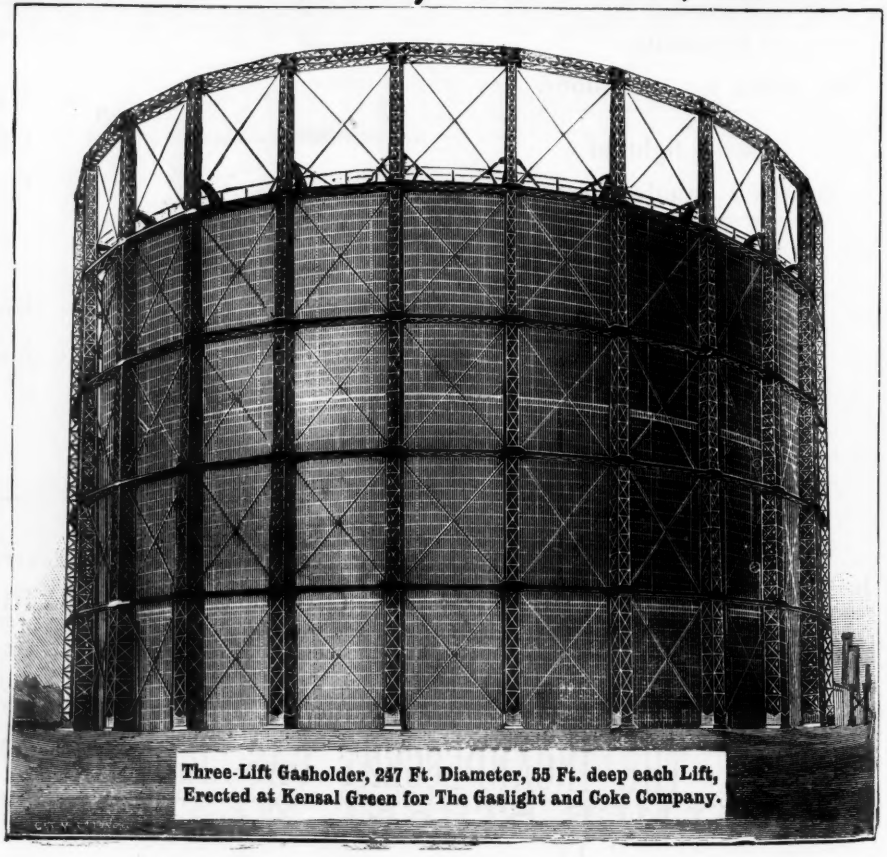

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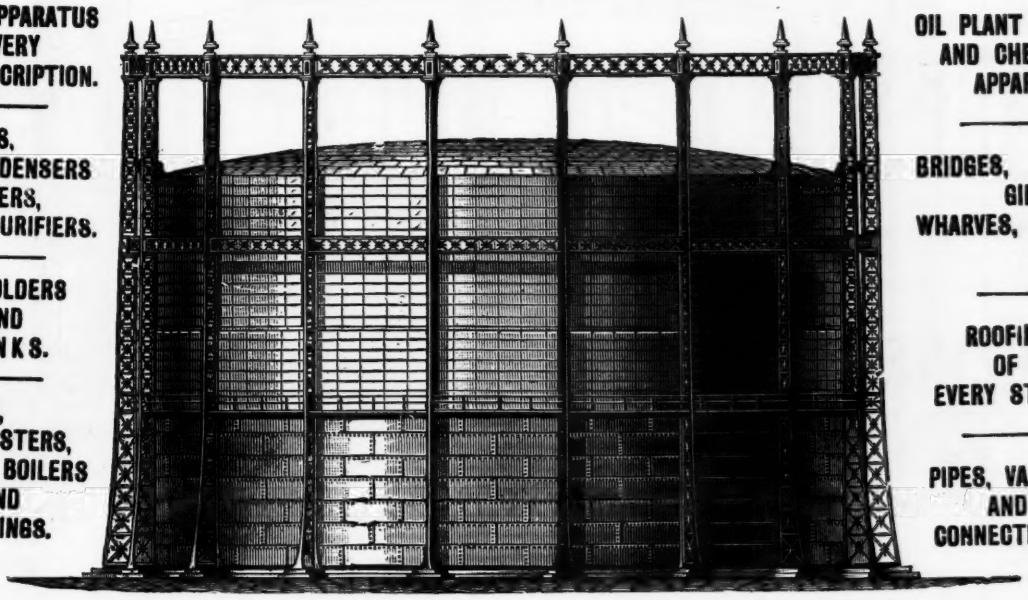

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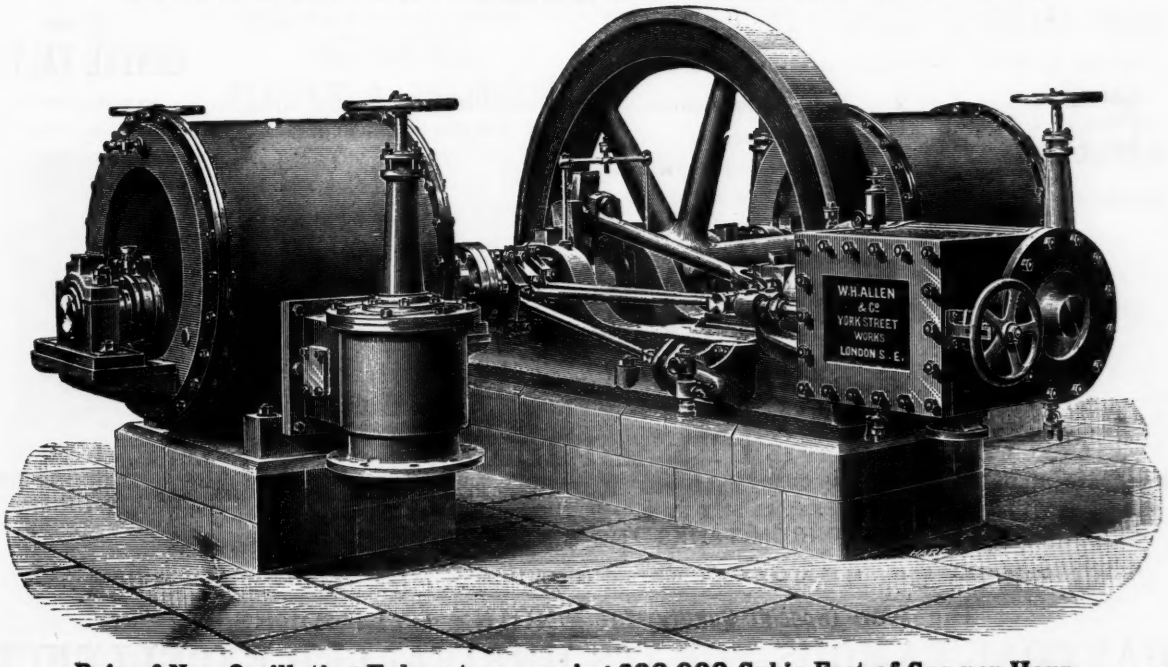

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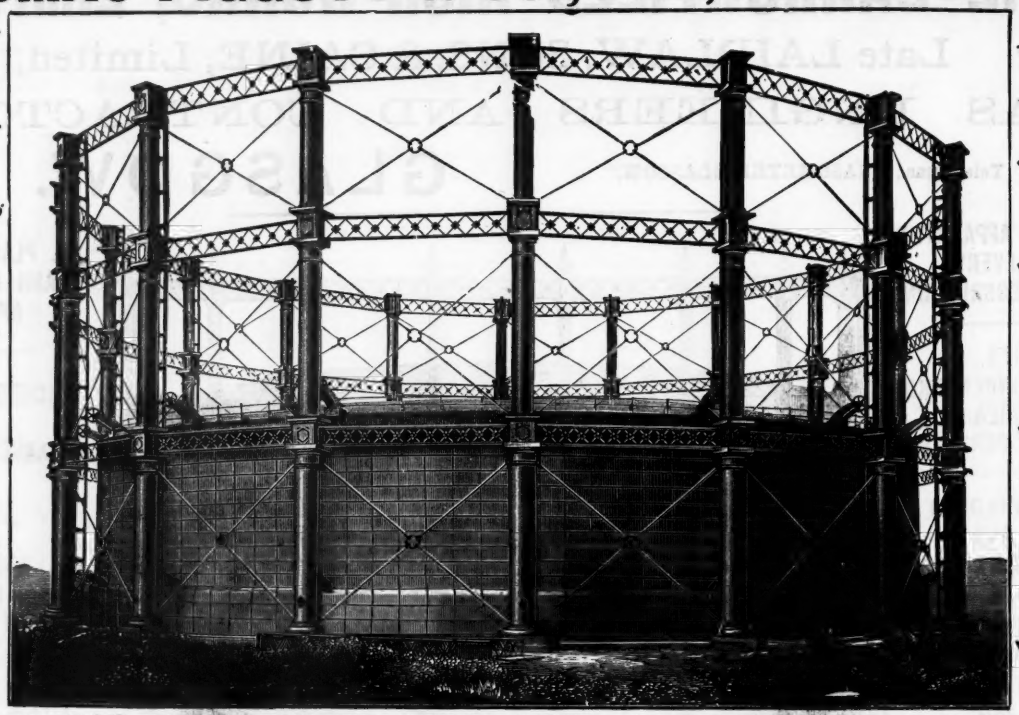

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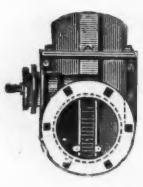

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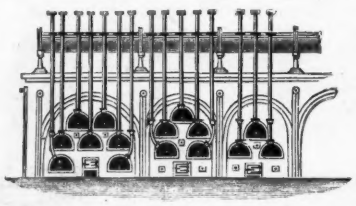

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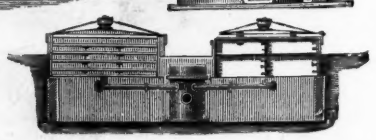

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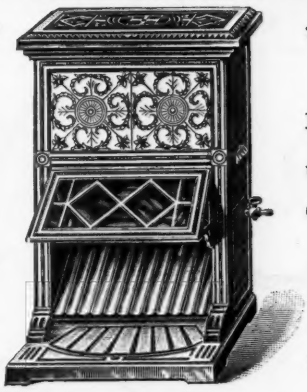

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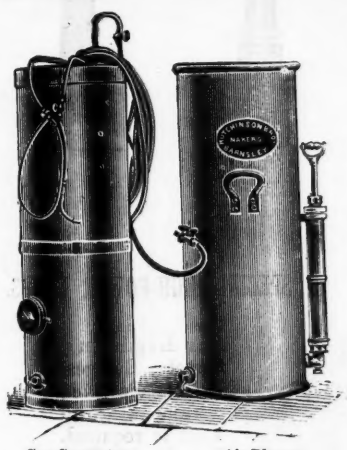
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IMPROVED LEAD-BURNING APPARATUS.

HUTCHINSON BROS.,
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SPECIALITY.
LEAD WORK FOR SULPHATE OF AMMONIA PLANTS,
BEST QUALITY OF MATERIAL AND WORKMANSHIP.
SATURATORS, all Lead, or Strong Sheet Lead, in Wood Casing.
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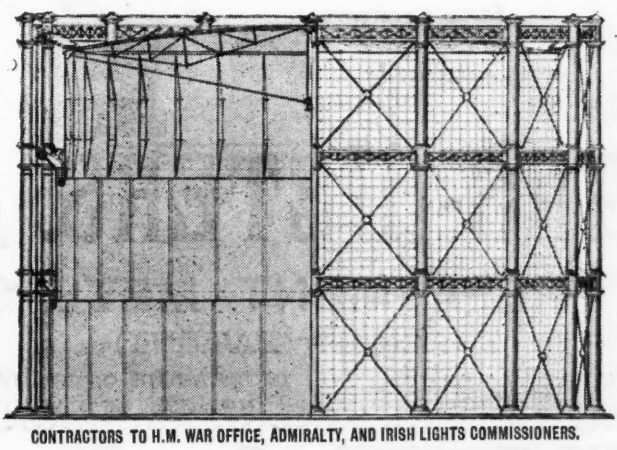

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CONTRACTORS TO H.M. WAR OFFICE, ADMIRALTY, AND IRISH LIGHTS COMMISSIONERS.
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EACH LIFT 28 FEET DEEP.
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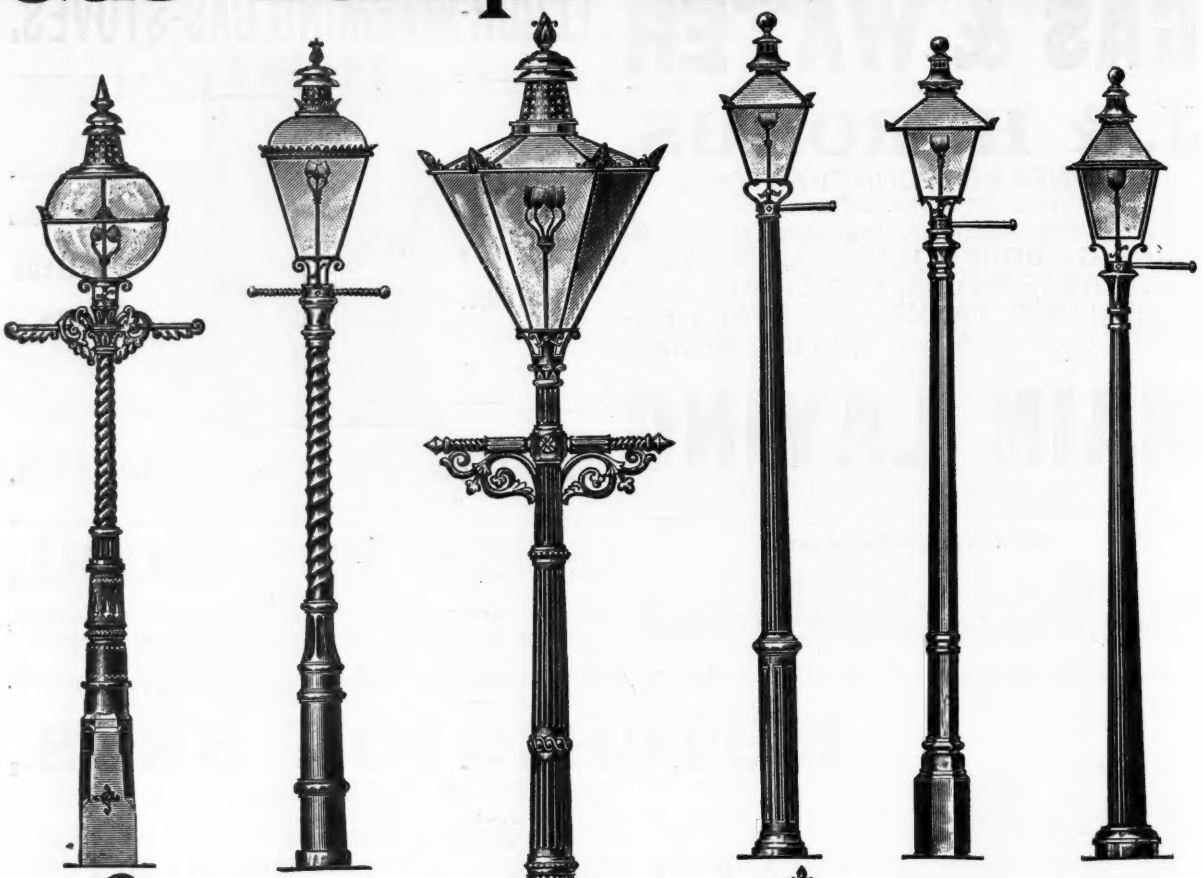

Several thousands of these are now in use, giving general satisfaction. They are strongly made, and of best material.

Patent Street Lamps.

NO PUTTY.

Lamplighters' Torches.

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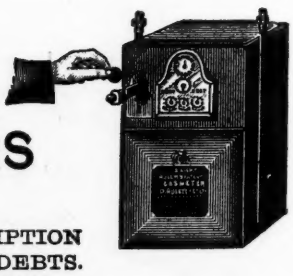
PRICE LIST ON APPLICATION.

SPECIAL HIGH-POWER LAMPS.

For Lighting Streets, Refuges, Promenades, &c., where a good light is required. Fitted with Porcelain cone, Copper top and perforation, Wrought-Iron Spray, Lever Tap, Burner and Patent Governor, glazed with Opal top.

GAS-METERS.



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(PRICE'S PATENT)

SPECIALLY ADAPTED FOR INCREASING CONSUMPTION AMONG SMALL CONSUMERS. NO RISK OF BAD DEBTS.

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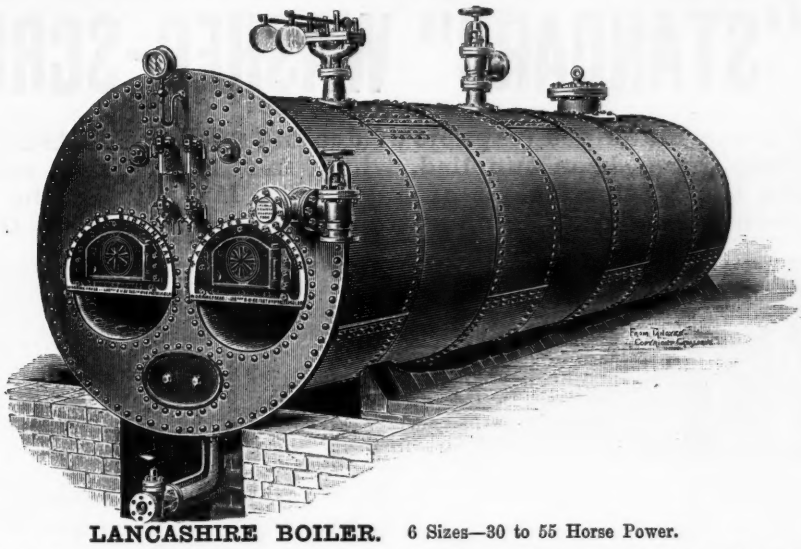
TANGYES'
REVISED STEEL BOILERS.



LANCASHIRE BOILER. 6 Sizes—30 to 55 Horse Power.

MADE OF BEST MILD STEEL PLATES, BY SPECIAL MACHINERY,

IN THE

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AND LONDON, NEWCASTLE, MANCHESTER, GLASGOW, SYDNEY, MELBOURNE, JOHANNESBURG, BILBAO, ROTTERDAM, AND CALCUTTA.

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PURIFIERS, SCRUBBERS, CONDENSERS, WASHERS, TANKS. VALVES,

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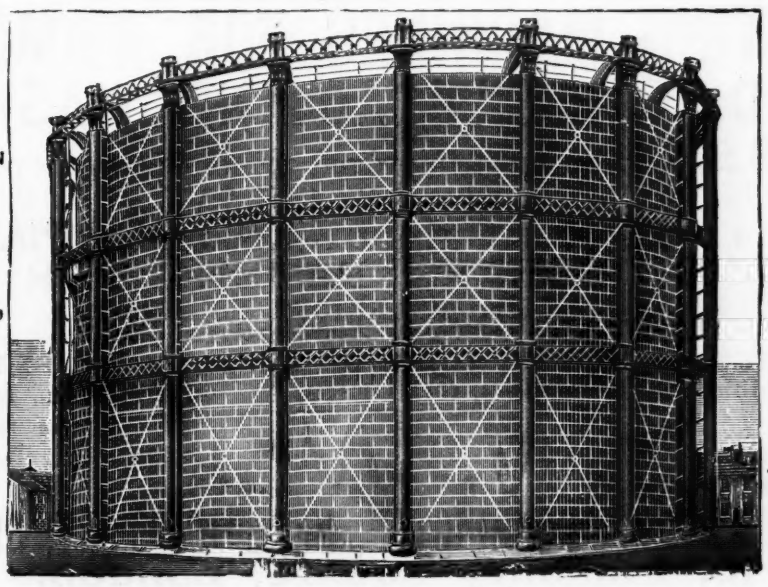

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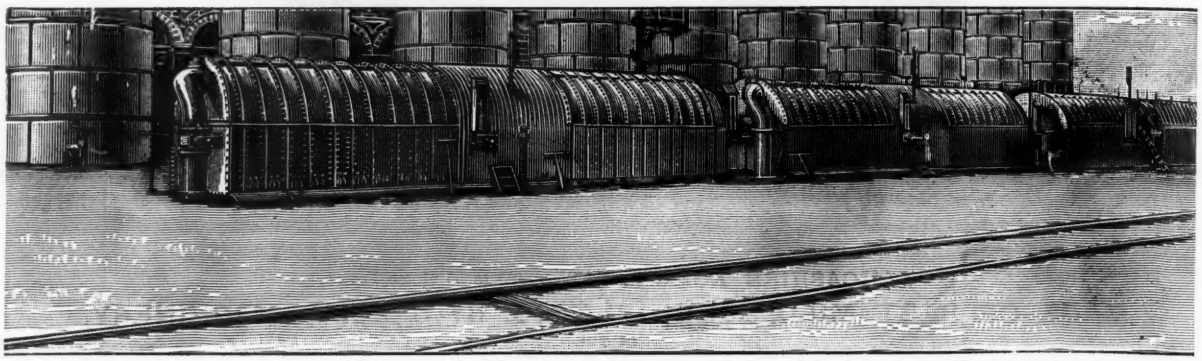
PATENT "STANDARD" WASHER-SCRUBBER.

☞ **467** of these Machines (capable of dealing with **447,807,000** cubic feet of Gas daily) have been supplied, which fact is given as evidence of this apparatus being the Most Efficient of any in the Market for the extraction of Ammonia, Carbonic Acid, and Sulphuretted Hydrogen from Coal Gas.



View of SIX PATENT "STANDARD" WASHER-SCRUBBERS, erected at the Beckton Station of The Gaslight and Coke Company (the Engines driving same being under Galvanized Iron Covers). This Company has **27** of these Machines in use, and Two more, each for 3½ million feet per day, are in course of construction for them. They are also in operation at a great number of Gas and other Works in this Country and abroad.

Address : 3 & 4, Palace Chambers, Bridge St., Westminster, S.W.

GASHOLDERS

A FOUR-LIFT Gasholder, nearly 200 FEET HIGH and 8 MILLION CUBIC FEET CAPACITY, erected by us for The Gaslight and Coke Company, London, has been in constant use upwards of a year.

PURIFYING MACHINES FOR AMMONIA;

CO_2 AND TAR-EXTRACTING WASHERS;

SCRUBBERS, on most improved principles, with planed joints.

PATENT SULPHATE OF AMMONIA PLANT.

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PATENT TAR-BURNERS,

CENTRE-VALVES and SLIDE-VALVES of all kinds, WOOD SIEVES of best possible make, ROOFS, GIRDERS, FLOORING, &c., &c.

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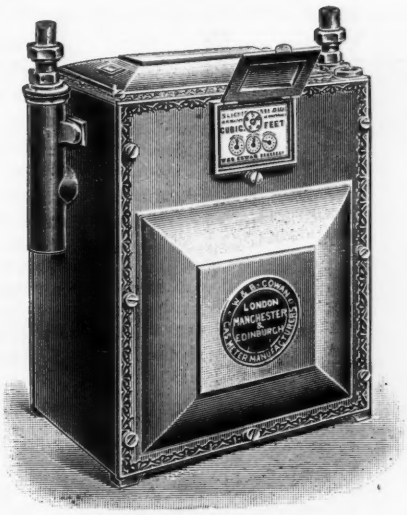
W. & B. COWAN'S DRY METERS.

Meter in Tin-plate Case.



Meter in Cast-Iron Case.

THESE which are made at our Factories in London, Manchester, and Edinburgh, are constructed of the best charcoal tinned plates, and the diaphragms of the best Persian sheepskins, specially selected and prepared. The diaphragm is tied with Bessemer steel wire, between which and the leather a band of flax webbing is interposed, so as to protect the latter. By this means leakage at the tying is rendered impossible.

Leakage at the index box is effectually prevented by the adoption of a grease cup in connection with the ordinary stuffing-box. A prolonged experience of this modification, which we introduced in 1878, justifies its recommendation as a substantial improvement.

Excepting as regards the cases, the above remarks apply equally to the Patent Improved Cast-Iron Cased Dry Meters recently introduced by us, the essential feature of which is that all the internal fittings are *exactly similar* to those of tin-cased Dry Meters; and it is therefore impossible for rust or other foreign substance to come in contact with the valves, as it is liable to do in iron dry meters as ordinarily constructed.

All the sizes of these Meters are of neat design, and are unexcelled for workmanship, material, and finish. The most careful supervision is exercised at every stage of their manufacture, and only the highest class of skilled labour is employed.

Large Stocks always Ready for Immediate Delivery, or for Shipment.

W. & B. COWAN,

ESTABLISHED 1827

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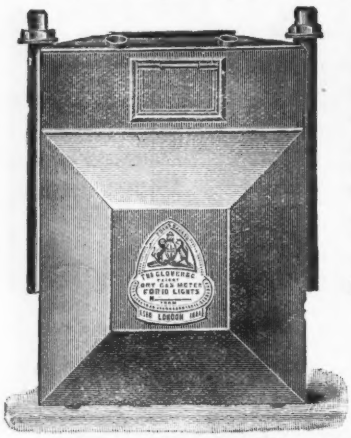
LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;

The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.



1st.—Are a remedy for all the defects of Wet Meters.
2nd.—Are suitable for all Climates, whether hot or cold.
3rd.—Incur no loss of Gas by Evaporation.
4th.—Cannot become fixed by Frost, however severe.
5th.—Are the most accurate and unvarying measurers of Gas.
6th.—Prevent jumping or unexpected extinction of the Lights.
7th.—May be fixed either above or below the level of the Lights
8th.—Cannot be tampered with without visibly damaging the outer case.
9th.—Will last much longer than Wet Meters.
10th.—Will not cost more than one-half for repair that Wet or Water Meters do.

Are upheld for five years without charge.

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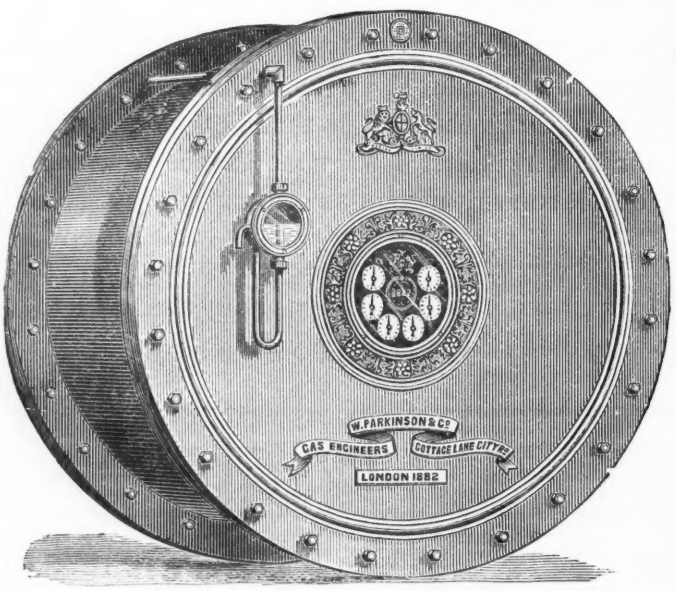
MANCHESTER: 37, BLACKFRIARS STREET. *Telegraphic Address*: "GOTHIC."

W. PARKINSON & CO.



STATION METERS

IN

ROUND or SQUARE TANKS.

500 STATION METERS,

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THREE-PARTITION DRUMS.

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COTTAGE LANE WORKS, CITY ROAD, **LONDON.** Telegraphic Address: "INDEX."

BELL BARN ROAD WORKS, **BIRMINGHAM.** Telegraphic Address: "GAS-METERS."

10, MAWSON'S CHAMBERS, DEANSGATE, **MANCHESTER.** Telegraphic Address: "PRECISION."

[See also Advt., p. 1108.

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TO CORRESPONDENTS.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, DECEMBER 12, 1893.

The Employers' Liability Bill Amended.

THE Employers' Liability Bill passed the Committee stage in the Lords last Friday; and it will now be returned to the House of Commons as amended. The principal amendment was the addition of the Earl of Dudley's clause permitting "contracting out" under certain conditions, which was carried by a majority of 120, although another and highly important alteration was also effected, without a division, in that part of the measure which refers to the employment of seamen. The insertion of the permission to workmen in any employment to contract out of the Act when they think themselves in possession of better terms than the new provisions for compensation offer them, has, of course, been hailed with unmeasured abuse by the partisans of the New Unionism. One of the newspapers which has swallowed whole the new dogma that Trade Union leaders can neither do wrong nor make a mistake, has set up the doctrine that there is nobody in the Upper House competent to utter an opinion upon a question of labour in contradiction of the infallible demagogues who have managed to jump from mass-meeting platforms into the House of Commons. These vilifications are all part of the game of party politics; but they do not dignify it. Whatever may be said on either side of this question of the expediency of permitting "contracting out"—and even the Marquis of Ripon, speaking for the Government, admitted that "there is a great deal to be said on both "sides"—it cannot be denied that the Government majority in the Commons on the issue was only 28, and that far greater pressure has been brought upon Lord Salisbury and his colleagues by deputations of workmen hostile to the measure than was ever exerted in its favour. It is true that the Trades Union Congress and the Executive of the Miners' Federation are backing up the Government. But they are not everybody; and it is difficult to understand why a number of workmen calling themselves a Trade Union should on this account be worthy of more respect than an equal number who do not claim any such corporate title. The Government are relying on the support of the "organized trades" in this matter; and they must take the consequences of their mistake if this prop turns out to be but a broken reed. As we have repeatedly observed in previous discussions on this subject, we do not regard the issue as of very great practical moment so far as workmen in good employ are concerned; and those who are less happily situated cannot be vastly benefited by receiving the right to sue employers no better off for capital than themselves. It is the hopeless confusion of principle in the Bill, and the glaring fact of its being concocted to curry favour with New Unionists, whose very existence is bound up in perpetuating ill-feeling between employers and employed, that cause us to dislike it as a specimen of opportunist legislation. Far too much has been said, in and out of Parliament, of the pecuniary aspect of employers' liability; and it has almost been contended that the amount of compensation provided by a particular accident fund condemned the whole principle of mutual insurance as between employers and employed. Surely this is an unworthy view of the main issue, which is well defined by the Bishop of Durham as consisting in the question whether the two parties in an industry should work in agreement or be hostile. It is always pleasant to coincide with a Bishop; and when Dr. Westcott remarked that "the material advantages obtained under "voluntary arrangements are highly valuable, but I value "still more the good will and mutual trust between "employer and employed which these arrangements pro-"duce," he uttered a sentiment that only the virulence of a paid strike agitator, trembling for his job, could distort into a declaration of enmity to the cause of Labour.

The Price of Gas in Birmingham.

THE report of the Gas Committee of the Birmingham Corporation, which will be found in substance in another column, together with the speech of Alderman Pollack and the discussion in the City Council, is a statement calculated to acquaint the community with the bearings of coal strikes upon gas supply. It has been the practice of the Birmingham Gas Committee to sail as closely as possible to the wind in settling their budget from year to year. They have no reserve fund out of which temporary irregularities of profit might be made good; and consequently when circumstances conspire to upset estimates, something has to bear the brunt. Last year the Committee were unable to meet all their obligations, and rather than disappoint the ratepayers of their customary subsidy out of the gas profits, and rather also than increase the price of gas, the Committee took the course of suspending for the year the usual provision for maintenance and renewals, and the instalment due to the sinking fund. This somewhat irregular proceeding was adopted as a choice of evils, simply because the Committee considered they had a reasonable prospect of recovering themselves during the current municipal year. The coal contracts had been made on favourable terms, the ammonia market was strengthening, and after a check in the development of the undertaking the Committee thought themselves

entitled to expect an increased consumption of gas. All this looked promising; but the one chance that Fate always holds in reserve, according to the philosophers, against all human plans, turned up to confound the foresight of the Birmingham Gas Committee, in the shape of the coal strike and lock-out. When this broke out, the stock of coal upon the works amounted to 76,000 tons; and by its close this reserve had been diminished to not more than 22,000 tons, or something under a week's supply. Meanwhile, of course, supplementary contracts had been entered into at advanced rates, representing an extra cost of £24,000; and, to make matters worse, the expected increase of gas consumption has not been realized, owing to persistent depression in trade which was probably more or less connected with the disturbance in the coal industry. Landed, therefore, with this unforeseen addition of £24,000 to their working expenses, the Gas Committee have raised the price of gas 3d. per 1000 cubic feet. Even so, since the increased revenue from this course can only come into the next, or last, quarter of the municipal year, it will be twelvemonths hence before the Committee are safely out of the wood. What has been found necessary in this respect in Birmingham has received corroboration by the experience of Leeds and other places drawing their supplies of gas coal from fields affected by the strike and lock-out. This is to be regretted; but it is just as well that the public should be made to understand that the assertions of the strike leaders, respecting the ability of wealthy gas undertakings to pay any money for their coal, mean no more than that the extra cost falls in the end upon the consumers. We notice that there is some dispute respecting the interpretation of the "strike clause" in connection with the recent troubles; and it is a question how far the clause can be held to cover a "lock-out." However this may end, the fact remains that the people of Birmingham are called upon to pay £24,000 as their proportion, in respect to gas alone, of the cost of the coal war. It is such an indemnity as a town might have to find to purchase the forbearance of a conqueror. Unhappily, the foe who has made this requisition on Birmingham is an enemy within the land, if not within the gates; and there is no telling when the demand may be repeated.

The Death of Professor Tyndall.

The death, under peculiarly melancholy circumstances, of Professor Tyndall was the event of the past week which probably affected the people of England most. As an ex-Gas Referee, Professor Tyndall is to be remembered among the deceased worthies who have helped to develop the gas industry of the United Kingdom; but it would be doing his name scant justice to mention it only in this connection. Professor Tyndall was one of the triad of London Gas Referees for many years; and though he did not come into prominence as a particularly active member of this body, it would probably be found, if all the doings of the Referees and the projects of gas testing that they made could be recorded, that the strong common sense of Professor Tyndall often served to keep the Referees straight. He was appointed a Gas Referee because of his eminence in science; he was not rendered more eminent by being made one. His case in this regard was precisely the same as that of many other distinguished persons who have helped to "create" newly-formed institutions. A few great names are connected with new administrative departures, as though to inspire confidence in them; and after a time the notabilities retire in favour of persons who will undertake the routine duties which constitute the every-day work of established organizations. Professor Tyndall made himself fresh friends in the gas industry not very long ago by his warm partisanship of the application of gas to lighthouse uses, which he considered was being improperly dealt with by the Trinity House authorities; and he threw up his appointment as Scientific Adviser to the Board of Trade, rather than appear to countenance what he regarded as a piece of official bad faith. This was characteristic of the man. He had been so fortunate in his career that his detractors accused him of being a time-server; but it cannot be denied that when once his ideas of right and wrong were engaged in regard to a matter of controversy, he allowed no consideration of expediency to stand in the way of what he understood to be his path of duty. In many respects, Professor Tyndall's life was his best work, although his work was very near the best of its kind. Strictly speaking, perhaps, he was not to be praised for his genius, either in research or in exposition; for this was born in him, and he was no more responsible for it than for the colour of his hair or the inches of his stature. What he deserved the utmost praise for, however, was the indomitable industry with which his genius was cultivated, and the self-restraint he must have practised for many years of his early life in order that the capabilities of his spirit might have full play. Let any self-satisfied youth of these times of cheap schooling and technical training who may be inclined to imagine that cleverness will suffice to render a man independent of labour and self-denial, take example from the life of Tyndall, and mark the successive stages by which the Irish chainman reached the Chair of Physics at the Royal Institution. Tyndall was fortunate in his epoch, perhaps; but he was worthy of all the good luck that came in his way. There are not many of his generation and class left—men of the era that witnessed the change wrought by Darwin, Grove, Lyell, and Joule in the habit of men's thoughts of the world and their own part in it. When Tyndall was in his prime, the conquests of science came thick and fast; and every meeting of the British Association proclaimed records of advances that left the world agape. It is no longer so. The men of that time are almost all gone; and the science of our day is but a gleaning in the fields which they not only discovered, but reaped of their first-fruits.

The "Lancet" on Gas-Stoves and the "Journal."

In the current number of the *Lancet*, reference is made to the critical notice we gave last week of the report of our medical contemporary's "Commission" on the "Use of "Gaseous Fuel." Our appreciation of the value of this report was freely given, and is on the whole fairly recognized in this rejoinder. But it also contains one or two remarks to which exception must be taken. For instance, our criticism of the misapplication of the word "fuel" arouses our contemporary's scorn as being "frivolous;" but that the objection is not wholly pointless is admitted by the writer to the extent that throughout his rejoinder he is careful to put the word between inverted commas "to avoid misinterpretation," and to mark the employment of the term in this sense as being "for convenience." It is asserted that we made out this slip in phraseology to be the "great shortcoming" of the report; and the observation is offered that nobody else has noticed it. This may well be; for we probably know more about the character of the retail gas-stove trade than the bulk of regular readers of the *Lancet*. It is not true, however, that in our notice this bit of slipshod diction was unduly magnified; the most serious reflection that was made upon the report, or rather the three reports, as a whole, being that they showed a certain lack of system in laying out the scope of the investigation so as to cover the whole ground. It was as though the inquirer "could "not see the wood for the trees." The little misunderstanding over the "fuel" of atmospheric gas-stoves was corrected by the Journal, because it is of a piece with the other popular error in regard to the atmospheric flame being necessarily more economical for any heating purpose than the luminous flame on account of so much air being burnt with it. This is a delusion which is a commonplace of the gas-stove trade, as conducted by the salesmen who have so much of the "say" in the matter to the uninstructed purchaser, and its mischievous effect in obstructing improvement in these commodities is well understood by gas engineers. The Journal is further accused by the writer in the *Lancet* of "entertaining an evident prejudice "against the introduction of appliances which give evidence "of an honest endeavour to deal with the proper and com-"plete burning of coal." This is because we charged the "Commissioner" with narrowing his early investigations to the consideration of one pattern of close warming-stove and one make of kitchener. It is pitiable to find a scientific periodical harbouring as against another this suspicion of the most short-sighted of prejudices. Surely, it might be considered to be as much to the interest of those who are solicitous for the prosperity of the gas industry to encourage economy in the use of all kinds of fuel, as it is for a medical practitioner to effect the speedy cure of his patients. We, at any rate, are past the stage of winking at any sort of extravagance as being "good "for trade."

The Indexing of Price Lists, &c.

It is not our intention to intervene in the discussion respecting the value of the so-called subject-matter index to The Gas Institute Transactions which is progressing in our "Correspondence" columns. The question of indexing, as a means of keeping within the reach of busy workers the substance of the enormous mass of technical and scientific literature which the printing-presses of the world pour over every science and industry practised by modern man, is one of the most serious problems of the age. No one knows how soon he may be constrained, by force of circumstances, to inquire as to what has been published in regard to some point of theory or practice; and we should be only too glad to be able to refer to a comprehensive scientific or technical index, because, as a rule, the first idea that occurs to one of our readers who may happen to be troubled in this way is to write to the Journal offices. It appears to be a popular delusion among our readers that we know almost everything—a compliment to be duly appreciated, so far as it goes, but a decidedly undesirable piece of flattery when it is only to be justified by putting somebody, who should be more profitably employed, at the task of turning over dozens of back volumes in search of some obscure record of law or fact. Indexing may have many objects; but one of the most troublesome varieties of it that comes within the ordinary range of office work is the cataloguing of trade circulars—most important publications in their way, but difficult to keep in place and to find when wanted. Mr. Albert D. Penz, writing on the subject in the *Engineering Review*, remarks that trade catalogues may be indexed as follows: When received, the specimen is either numbered at once or is put away with others until a month's receipts are in, and then all are numbered together and placed in boxes or drawers holding 25 or more. These receptacles are also numbered. When a lot is complete, they are looked over carefully, and every subject in each catalogue is entered upon a separate card, with the numbers of catalogue and receptacle. These cards are kept in cases such as are used in cataloguing libraries. Thus there may be any number of cards bearing the inscription "Consumers' "meters," all showing where the particular circular mentioned may be found. By this system, Mr. Penz says it takes not more than five minutes to find any subject, and all there is about it, in any price list in the office. Anything else, such as data relating to a particular subject, may be indexed in the same way. The suggestion is, at any rate, worthy of attention; and we shall be pleased to hear from our readers respecting the different devices of the same character which they may practise with the object of "keeping the hang of things," as the days bring their parcels of technical publications in order.

The Tatham Process Seeks the Protection of the Law.

It may or may not be a surprise to those of our readers who have followed the recent proceedings in connection with the propagandism of the Tatham process, to learn that our obstinacy in refusing to subscribe to the claims advanced on behalf of the system has been rewarded by the service of a writ, according to which the owners of the patents claim damages for "libel." We have instructed our Solicitors (Messrs. Linklater and Co.) to enter appearance in due course; and meanwhile take this opportunity of acquainting our readers with the actual state of affairs, in order that they may appreciate the conditions under which future references in the Journal to Tatham matters must be made. We have no intention to refrain from discharging what we may conceive to be our duty to technical readers and to investors, in this matter of legitimate public interest, by anything the Tatham group may do in the way of instituting legal proceedings which can have no other object than that of smothering unwelcome criticism. Our readers must judge for themselves as to the nature and purpose of the part we have taken in the controversy that has been provoked by the appearance of the oxy-oil gas process of carburetting in the technical field of the gas industry; and also as to the character of the case that it is sought to defend by a recourse to measures outside controversy. The issue of a writ is a cheap and handy device for dealing with journalistic critics; but we shall treat it for precisely so much as it is worth as an incident in the development of the Tatham affair—neither ignoring, despising, nor magnifying it.

WATER AND SANITARY AFFAIRS.

The London County Council have found it necessary to remove from their Water Bill the clause introduced at the instance of the General Purposes Committee, conferring "powers of supply." The reasons for this abatement of the "program" are sufficiently cogent, as set forth in the last report of the Parliamentary Committee, who were entrusted with the preparation of the Bill proposed by the Water Committee, and agreed upon by the Council. The collective wisdom of three Committees has thus been brought to bear upon the subject, in conjunction with the Council at large; and at last it has been discovered that the Council cannot supply water until they have obtained it, nor stand in a fair way of getting it until they show where it is to come from. Neither can a Bill be framed to give the Council powers of supply, until it has been decided on what terms, and on what principles of charge, the supply should be given. It is also admitted to be necessary that the "existing position" of the Water Companies should be taken into account, so as to settle the principles upon which the rights of the Companies should be dealt with. The Bill for the ensuing session, therefore, drops down into something which is to empower the Council "to purchase or acquire, as opportunity may "offer, any areas or water rights, the possession of which "the Council might regard as likely to be valuable in the "future." The Parliamentary Committee perceive that, in order to gain powers of supply, the Council must either purchase the existing Water Companies' undertakings, "or some of them," or obtain new powers for the construction of works, and the diversion of water from some river or streams. This, it is stated, cannot be effected otherwise than by parliamentary sanction, after plans and sections have been deposited, and the ordinary notices given. Thus the vista lengthens out; and the Council are made to see that property established by the authority of Parliament cannot be unceremoniously swallowed up or ignored. Despite the changes that have come to pass, property still has its rights; and resolutions passed at Spring Gardens are not quite equal in effect to the decisions of the Legislature ratified by the Royal Assent. A lordly disregard of certain obvious conditions presents itself in the very preamble of the Water Bill, where it is asserted, "Whereas it appears that the existing means "of water supply are inadequate." Mr. Westacott has called attention to this little piece of audacity, which coolly contradicts the conclusion arrived at by the Royal Commission, whereby it was stated that the existing resources were sufficient for the next forty years. As it is quite likely that the growth of the population will proceed at a rate slower than that for which the Commissioners have calculated, any apprehended deficiency in the supply becomes still more remote. Concerning the Bill, there is this fundamental fault attaching to it that, if it has any practical bearing whatever, it contemplates the bringing in of a competing supply; whereas Parliament has always required that a municipal authority seeking to supply water to a town should include in its scheme the purchase of the existing undertakings. The initiatory step has not been taken by the Council, nor do they propose it, except that, by a strategic movement, they are trying to prepare the way for spoliating the Companies. There is a plea for the present Bill that, if London takes no action to secure "the high gathering-grounds," which might be secured by such a measure, these will be seized by other parties. But it is not yet shown that London has need of these elevated regions as a source of water supply. Another argument is that, if the Bill passes, the Council might acquire sources of supply and lease them to the Companies "for the present;" so that the Council might not have to re-purchase them at some future time at an advanced price. For this little transaction, it would seem necessary that there should be an understanding beforehand. The Council may take land, and be simply left to hold it. If any land is wanted for the purposes of the water supply, the Companies are quite prepared to take it without the help of the County Council. Neither are the Companies likely to put their heads into such a noose as this ingenious suggestion involves.

The Management of the Kirkby Stephen Gas-Works.—Mr. John Townsend, of the Carlisle Corporation Gas-Works, has been appointed Manager of the Kirkby Stephen Gas-Works.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1097.)

THE fair promise of a general improvement in the position of the Stock Exchange, to which we adverted a week ago, and in which some believed, and many more tried to believe, has not been fulfilled. It is almost disheartening to have to record that prices have fallen back again almost to where they started. The fact seems to be that the revival was a little overdone at the start, and was forced to an unnatural extent; and the result has been a considerable rush to snap up a profit wherever it could be had—this being a process which there has not been very much of lately. At the same time, the continual hardening of the Money Market had a tendency to influence prices in the downward direction. This, however, is capable of being regarded as of favourable complexion; for a considerable proportion of the demand was for home purposes, and the profitable employment of capital for revivifying the trade of the country must have a beneficial effect all round. During the week, the only class of security which has done well has been the "gilt-edged" division; but, the demand for money being better, they have not been very active. Business in the Gas Market has been well up to the mark in point of volume; and, though two or three issues are a little easier, yet on the whole the tone was firm. In Gaslights, the "A" was active and steady; transactions being daily recorded at much about the same figures—ranging a point or so above and below 232, which may be taken as the average figure. The request for the debenture and preference issues continued brisk; and further advances were effected, even above the large improvements scored the week before. In South Metropolitans, the "A" and "B" were steady; but "C" fell back. In Commercials, some of the old stock changed hands at fair prices; but nothing was done in the new. The Company are going to reduce their price for gas at Christmas, which is a favourable sign, and should stimulate business. The Suburban and Provincial undertakings were considerably more active; but nothing moved, except Alliance and Dublin, which, from local causes, relapsed slightly. Crystal Palace is now quoted as a 5 per cent. standard stock, and at a very good figure too. The Continentals were firm—Imperial showing some activity at even prices; while European made a further advance. Of the rest, Bahia was better; but Pará receded. Bombay also fell back. Business in Water was a good deal quieter; and movements were few and irregular.

The daily operations were: The Gas Market was firm and active on the opening day; prices in general being well up to the mark, but quotations did not change. In Water, Lambeths were offered; and the quotation fell 2. On Tuesday, satisfactory prices were again the general rule. Crystal Palace rose 2; and European, ½. New River advanced 3. Wednesday's business was rather quieter; and most prices remained steady, though Alliance and Dublin receded ¼. New River rose 2 more. Thursday was a repetition of the previous day; and quotations held firm except for a fall of ¼ in Bombay. Transactions were brisk on Friday; and prices in general were good. Gaslight "C," "D," and "E," and "K," rose 2 each; and ditto 4 per cent. debentures, 1½. But Pará fell ¼. New River again rose 3. On Saturday business was more nearly at its usual level. South Metropolitan "C" receded 3; but Bahia gained ½.

ELECTRIC LIGHTING MEMORANDA.

The Cost of All-Day Incandescent Electric Lighting—The Misdirected Labour of Mr. Reckenzaun—An Electrified City—Electricians Caught in their Own Trap.

COMMENTING on the expiry of the incandescent lamp patent, the *Electrician* has remarked that the most noteworthy result has so far been a large crop of offers of lamps of high efficiency, but no novelties. It is then explained that what central station engineers would like to see is an economical lamp for use in basements, passages, and the less important regions of houses generally, where gas is still in use even while electric lamps are favoured for the better rooms. Such an extension of electric lighting would help to swell the day load; but hitherto, as is significantly remarked, "many consumers, aware that the all-day use of glow lamps in kitchens, sculleries, &c., would cost as much as, if not more than, the whole of the ordinary domestic lighting, have allowed gas to remain in these places." Our contemporary argues for the use in these lower regions of 8-candle lamps taking 2·5 watts per candle, costing 1s. 6d. each, and needing renewal five times a year. With current costing 6d. per unit, the running expense of such a lamp, reckoning it to be used 14 hours a day for 300 days, would only be £2 19s. 6d. —quite a trifle, as the cost of such lighting usually goes. A gas-burner consuming 3 cubic feet of London gas per hour would do the same work for something less than 40s., including everything. Householders in electric lighting districts who lay claim to a spark of public spirit ought, of course, to give their servants the same privileges in the matter of lighting that they use themselves; but it is rather to be feared that, if the electricians could get the economical lamp they pine for, the superior economy of gas would still appeal to the average householder, at least in regard to kitchen lighting. The very aspiration after what they call cheap lighting, moreover, shows how far the existing lamps are from yielding a reasonably cheap service. Instead of 2·5 watts per candle, the average consumption is 4 watts, or even more; so that actually the cost of an all-day lamp of the candle form named by the *Electrician*, instead of being less than £3 a year, would run the user into an outlay of between £5 and £6.

Although electrical engineering is among the youngest of the scientific industries, it has already a death-roll of only too considerable length. One after another, several of the pioneers of the application of strong currents of electricity to practical purposes have dropped out of the field of labour which they endeavoured to make fruitful; and as these pass, the technical journals have to write biographical notices of them which amount to brief histories of their chosen industry. The last to go in this way was Mr. Anthony Reckenzaun, an electrical engineer of Austrian extraction, who made a speciality of the adaptation of accumulators for locomotive purposes. We have every reason to believe that Mr. Reckenzaun was exceptionally well qualified to solve the problems to which he addressed himself in the matter of electric launches and tramcars; but the fact remains, as the *Electrician* was fain to admit in summing up the life-work of the deceased engineer, that accumulators have not proved worthy of the labour which he expended upon their applications. Mr. Reckenzaun devoted his life to making accumulators useful; and they disappointed him. He died before seeing any real success resulting from his labours in this regard; and the chief care of his friends is to put the character of his work on record, "lest some inventor should hereafter improve the secondary battery, and make it a success for locomotion, and take, or be given credit for, the work which was so well done by Anthony Reckenzaun."

There was once an American poet named Longfellow, and he sang sweetly of "The Happiest Land." According to a correspondent of an American electrical periodical, if the most "advanced" town in the matter of electrical advantages is also to be regarded as the most fortunate, and in all respects most comfortable to live in, somebody ought to pick up Longfellow's harp, and sing of Great Falls, Montana. This is, *par excellence*, the electric city of the world. The Missouri has been dammed three miles above the town, and hydraulic power works erected large enough to supply the citizens with all the electricity they can possibly use or play with. There is no night there; and every thoroughfare is served by tramcars, not only propelled and lighted by electricity, but also warmed by means of electric radiators. Elevators, printing-presses, cranes, and all kinds of machinery, are driven by the ubiquitous force. There are automatic excavators, electric pumps, and electric rock-crushers to replace the Irishman. The cooking in the restaurants and private residences is done by electricity. The butcher employs it to chop his sausage meat; the grocer, to grind his coffee; the tailor, to heat his goose, or to cook it, as the case may be. "The subtle fluid is a welcome blessing in every home; the housewives run their sewing-machines and heat their flat irons by electricity; . . they have electric boilers, and broilers, and tea-kettles," and other conveniences of the same kind too numerous to name. And yet the chilling suspicion creeps over the mind, and will not be shaken off, that the sum of human happiness may not be noticeably greater in this electrified locality than it is in poor old London, where at this season of the year two or three people may often be discovered gathered in a still gaslit kitchen, feasting on sprats cooked over the convenient fire.

A certain electrical periodical has raised a lament which cannot fail to awaken a responsive sympathetic chord in the breast of anyone who has ever taken the performance of an arc lamp upon the valuation of an electrical supply company. It refers to the iniquitous trick of makers of turbines, who, we are told, are in the habit of ascribing fancy efficiencies to these occasionally useful machines, and so deceiving the artless electrician who trusts in them. It is very sad, of course; but did the electricians really believe, when they introduced the figment of "French measurement," that they were to have all the benefit of the device? Mechanical engineers are quite up to the commercial value of "nominal" ratings of the power of machinery; and to hear of an electric lighting company deceived in this way is a joy almost too deep for tears.

The Management of the Dunedin Corporation Gas-Works.—Mr. H. B. Courtis has received the appointment of Engineer of the Dunedin (N.Z.) Corporation Gas-Works, in succession to the late Mr. Graham, whose death is recorded elsewhere.

Junior Engineering Society.—At the meeting of this Society last Friday evening, Mr. S. Cutler, jun., read a paper on "Coal Gas Manufacture, and the Most Recent Improvements Employed Therein." By way of introduction, the author gave a few statistics as to the magnitude of the gas industry of this country; and he then proceeded to describe in detail, by the aid of diagrams, &c., the processes of gas manufacture and measurement, and the appliances used in these operations. He closed his paper with some observations on the subject of gas and electric lighting; concluding by expressing the opinion that the gas industry is an extremely strong one, and is likely to remain so a very long time. We shall take an opportunity of referring again to the paper, which gave rise to a discussion.

JOHN TYNDALL.

THE death of Professor Tyndall, which took place on Monday evening last week, at his residence at Haslemere, under distressing circumstances (the cause having been the accidental administration of a dose of chloral by his wife), calls for more than the customary regretful record of the sad event in these columns, from the connection of the late distinguished scientist, in his capacity of one of the Metropolitan Gas Referees, with the Gas Supply of London. Professor Tyndall was not one of the original Referees appointed under the provisions of the City of London Gas Act, 1868; and it was not till after these gentlemen had completed their introductory labours that he became associated with Dr. Pole and Mr. A. Vernon Harcourt in the work of defining and supervising the conditions, as to quality and illuminating power, under which gas has to be sold in the Metropolis. The usual half-yearly "Notification"—which, apart from the alteration in the permissible quantity of sulphur in summer and winter, varied but little—bore the names of Dr. Pole, Mr. Vernon Harcourt, and Professor Tyndall, down to about two years ago, when the last was replaced by that of Professor A. W. Rücker. The deceased was a firm believer in gas as an illuminant for lighthouses; and our readers will doubtless remember his vigorous defence of it at the time of the appointment of the Board of Trade Committee, some ten years ago, to experiment with various lights. In his capacity of Scientific Adviser to the Board of Trade and the lighthouse authorities, he expressed great dissatisfaction with the constitution of the Committee, which he thought would be prejudicial to gas as consumed in the most improved appliances. His controversy with the then President of the Board (Mr. J. Chamberlain), his subsequent resignation of his position, and the questions in Parliament resulting from this step, need not be referred to in detail here. Suffice it to say that he held to the last the opinions he had so often forcibly expressed as to the relative merits of gas and electricity as lighthouse illuminants.

Of Professor Tyndall's life-work, a brief outline may be given in connection with the foregoing notice of that portion of it with which readers of the JOURNAL are more immediately concerned. He was born in Ireland in 1820; his father being a man of singular force of intellect and independence of character. Young Tyndall left school in 1839, with, among other things, a fair knowledge of mathematics. In that year he joined, in the capacity of "Civil Assistant," a division of the Ordnance Survey, with which he remained for nearly five years; obtaining experience of nearly all departments of the work. His original intention was to be a civil engineer; but in 1844 (after very nearly deciding to emigrate to America), he was employed by a firm in Manchester, and for about four years he was engaged in engineering work connected with railways. Meantime he devoted what leisure he had to the study of science; and in 1847 he accepted a post at Queenswood College, Hants, where Mr. (afterwards Dr.) Frankland was Chemist. In 1848 they went together to the University of Marburg, in Hesse-Cassel, to work under Bunsen, to whom Tyndall said he owed obligations never to be forgotten. Here also he studied mathematics and attended lectures, and carried on researches in physics under Gerling and Knoblauch. Tyndall subsequently worked in the laboratory of Magnus, of Berlin; and there he became the friend of some of the greatest scientific men of the day. In 1850 he first made Faraday's acquaintance by calling upon the great master at the Royal Institution with one of his papers. In 1851 he accompanied Professor Huxley to the meeting of the British Association at Ipswich; and thus commenced a close friendship which lasted to the end.

While still a student in Germany, Tyndall entered on the work of original investigation. His first scientific paper was a mathematical dissertation (when he took his degree at Marburg) on "Screw Surfaces;" and his first physical paper was on the "Phenomena of a Water-Jet." His investigations, under Dr. Knoblauch and afterwards, into the subject of magnetism procured for him, at a somewhat early age admission to the Royal Society, and, during the first year of his return to England, the Chair of Physics in the newly-established School of Mines. The next year (1853), he was appointed Professor of Natural Philosophy in the Royal Institution; and, on Faraday's resignation, he succeeded him as Superintendent of the Laboratory. The first paper which he communicated to the Royal Society was on "Molecular Influences—the Transmission of Heat through Organic Substances;" and it exhibits all that skill in experimenting and fertility of resource which distinguished his future work. This memoir was the forerunner of a long succession published in the "Philosophical Transactions," including papers on "The Transmission of Heat through Gaseous Bodies," "Radiation," "Calorescence," "The Invisible Radiation of the Electric Light," and "Sounding and Sensitive Flames." It was during his tenure of the Bakerian Lectureship in 1855 and 1861, that he discoursed on "The Absorption and Radiation of Heat by Gases and Vapours," and on "The Physical Connection of Radiation, Absorption, and Conduction." He extended his researches on radiant heat, previously confined to solids and liquids, and showed the relation of absorption and radiation to chemical combination. Many of the results of his investigation of this subject he embodied in his work on "Heat a Mode of Motion." He retired from the Institution in 1887.

The late Professor Tyndall was the recipient of many honours. In 1864 he received the Rumford Medal of the Royal Society, the membership of various foreign Academies, and that position in the Board of Trade and the Trinity House to which reference has already been made. Cambridge and Edinburgh bestowed on him their degree of LL.D.; Halle created him Ph.D.; and Oxford followed with her D.C.L. In 1874 he was President of the Belfast meeting of the British Association; and in 1877 he was elected President of the Birmingham and Midland Institute. In 1876 he married a daughter of Lord Claud Hamilton.

Professor Tyndall's health began to fail about three years ago, when symptoms of cerebral disturbance, in the shape of insomnia, showed themselves. His condition was known to be serious, and his friends were not unprepared for a fatal termination; but the end came unexpectedly. "By his death," says *The Times*, "Science has lost one of the three great leaders in the battle which she has fought during the last forty years. The greatest of them all—Darwin—was laid to rest years ago; and Professor Huxley is now the sole survivor of the 'dauntless three.' Tyndall's fame among his contemporaries at large was due mainly to the fact that he was a masterly expounder of the results of science, an unrivalled experimentalist, and an unsurpassed controversialist."

The Management of the Denbigh Gas-Works.—The management of the gas-works at Denbigh has been entrusted to Mr. Robert M'Gill, of the Carlisle Corporation Gas-Works.

The Issue of Debenture Stock of the Croydon Gas Company.—In response to the invitations which appeared a few weeks ago in our advertisement columns, tenders for the £8500 of 4 per cent. mortgage debentures of the Croydon Gas Company were received by the Directors on the 28th ult. We learn that the stock has been disposed of at an average price of £104 5s. 3d. per £100.

Reduction in Price by the Commercial Gas Company.—Our readers will no doubt remember that, at the last meeting of the Commercial Gas Company, the Chairman (Mr. J. Blacket Gill) intimated that it was the intention of the Directors to reduce the price of gas 2d. per 1000 cubic feet as from Christmas, unless something unforeseen happened to prevent it. This reduction has now been publicly announced; so that the consumers will have their gas at 2s. 7d. instead of 2s. 9d. per 1000 cubic feet.

Institution of Civil Engineers.—At the ordinary meeting of the Institution last Tuesday, it was announced that 23 associate members had been transferred to the class of members; among them being Mr. T. O. Paterson, Engineer and Manager of the Birkenhead Corporation Gas-Works, and Messrs. J. H. Briggs and H. Smith, of the firm of Messrs. James Simpson and Co. The first ballot for the present session, which took place on the same occasion, resulted in the election of 7 members and 122 associate members. Among the latter were the following gentlemen connected with gas undertakings: Mr. H. M. Drummond, of Antofagasta, Chili; Mr. W. Hardie, jun., of North Shields; and Mr. H. Pooley, of Dunfermline.

The Certification of Candles by the Metropolitan Gas Referees.—The Gas Referees last week issued a "Notification" as to the candles to be used for testing the illuminating power of the gas supplied to the Metropolis. This was called for in consequence of the Chief Gas Examiner having disallowed a certain return of the illuminating power of gas on the ground that "candles of different manufacture, possibly of different illuminating power, from those usually employed in the testing-places, and which had not been prescribed nor certified by the Gas Referees, were employed in the tests against which the Company appealed." Acting, therefore, under powers conferred on them by The Gas-light and Coke Company Act, 1876, section 34, the Referees have issued explicit instructions as to the manufacture of the candles to be used in the different testing-places, still retaining the definition contained in the Companies' Acts, that they are to be "sperm candles of six to the pound, each burning 120 grains an hour." We understand that it is contemplated, after a reasonable time has elapsed to permit of the manufacture and examination of the candles, that "certified candles" will be sent to the various testing-stations.

Presentation to Mr. W. Winstanley.—An interesting ceremony took place at the Newcastle-under-Lyme Gas-Works on Monday evening last week. The occasion was the presentation of a handsome marble timepiece to the Engineer and Manager, Mr. W. Winstanley, Assoc.M.Inst.C.E., by the workmen and staff. In making the presentation, the cashier (Mr. A. S. Howarth) referred to Mr. Winstanley's valuable services and blameless character as Manager of the works for the past nineteen years. Messrs. Hughes and Hambleton, foremen, also made a few appropriate remarks, and wished their Manager all happiness and prosperity in years to come. They also sympathized with him in the anxieties he had had to bear in connection with the gas undertaking in the past twelve months. Mr. Winstanley, who was very much surprised and pleased, thanked the men for their kindness and sympathy, and left the room amid loud applause. The timepiece bears the following inscription: "Presented to W. Winstanley, Esq., C.E., by the employees of the Newcastle-under-Lyme Corporation Gas Department, as a mark of their sincere esteem, respect, and confidence in him as Engineer and Manager of the works for the past nineteen years. December, 1893."

EMPLOYERS' LIABILITY IN GERMANY.

A FORTNIGHT ago we gave a brief introductory notice of the report by Mr. Geoffrey Drage, Secretary of the Royal Commission on Labour, on the "Labour Question in Germany." This publication deserves more extended consideration, as it is one of the most important of the volumes yet issued by authority of the Commission, and has accordingly been discussed at considerable length in the principal daily newspapers. We have already recognized the value of Mr. Drage's work as an aid to the study of German Socialism, the principles of which have been so largely drawn upon by the devisers of our New Trade Unionism as to warrant the statement that without Marx there could have been no Mann, Tillett, or Burns. The next point that calls for attention in Mr. Drage's report is peculiarly interesting just now, when the Employers' Liability Bill is trembling in the legislative balance, inasmuch as it is concerned with the origination and working of the celebrated compulsory accident insurance law of the German Empire. This movement appears to have begun in 1884; and the first law on the subject only contemplated making provision for the payment of indemnities to workmen accidentally injured in the course of their ordinary employment. Under this law, the employers in different industries were compelled to unite in trade associations, the number and scope of which were increased and enlarged under successive amendments of the law. Membership in these associations is compulsory, and begins for every employer on the day of opening his establishment. The associations are subject to the control of the Imperial Insurance Office; but they enjoy a large share of self-government. There must be a committee of management and a general meeting, either of all the members or of their delegates. Large associations may be divided into sections, with sectional committees, sectional meetings, and trustees. At the present time the number of general committees is 112; of sectional committees, 915; and of trustees, 16,000. These associations may issue regulations regarding the protection of machinery, and the adoption of certain appliances, or of working rules, for the prevention of accidents. Mr. Drage observes that, when the Insurance Law was passed, it was regarded by many of the friends of the labour movement as likely to result in the growth of a spirit of conciliation amongst employers and employed. To this end the representation of the workmen was insisted upon, and was recognized in the constitution of the Imperial Insurance Office itself. This combination was intended to prepare the way for handing over to the associations the control of a number of matters connected with labour, such as insurance against old age and infirmity, sanitary regulations, the restriction of the labour of women and children, and the supervision of factory regulations. These expectations have so far not been fulfilled; and the associations do not as yet control anything beyond the accident insurance funds.

It must not be overlooked that the introduction of compulsory accident insurance in Germany was facilitated by the precedent of the provision made by the mediæval guilds, or close trade corporations, for the support of members incapacitated by any cause from supporting themselves. Besides this, there was in different States special legislation to the same effect in the interest of workpeople. In course of time, however, and corresponding with the introduction and growth of the factory system, these antiquated arrangements broke down; and accordingly the Imperial German Government was at length compelled to adopt a decided line of action with regard to workmen's insurance. It is worthy of note here that the legal right of workmen to compensation for injuries sustained in the pursuance of their ordinary employment, which is supposed to be the essence of the Employers' Liability Bill now engaging the attention of the Parliament of Great Britain, existed in Germany from an early period. The burden of proof rested upon the injured workman, who was only entitled to relief if he could show the accident to be due to the fault or negligence of the employer or his officials. A railway servant was entitled to compensation, unless the employers could plead circumstances beyond their control (*vis major*), or fault on the part of the injured person. "The expense incurred in such actions for compensation deterred the workmen from bringing them, while, on the other hand, the satisfaction of just claims was often a heavy burden upon the individual employer; and the whole working of the law was a source of growing bitterness between employer and employed." This is Mr. Drage's picture of the working of the arrangement which the Government, driven by the Trade Union vote, is at the present time trying to force upon the United Kingdom.

To cure this evil, as well as remove the pecuniary attractions held out by the Social Democrats, the German Government embarked upon a scheme of compulsory sickness insurance. The principle of local and trade action was sedulously followed in the organization of the sick relief funds; and the whole arrangements made in this regard, as detailed by Mr. Drage, seem instinct with wisdom, liberality, and sympathy with every interest involved. So long as the insurance is effective, the Imperial Government does not interfere. The general principle on which the contributions to all these funds, excepting those of the miners' friendly societies, are assessed is that two-thirds must be paid by the persons insured, and one-third by their employers. As a rule, the contributions amount in all to 1½ per cent. of the average daily wages—1 per cent. paid by the workmen, and ½ per cent. by their employers. With the consent of the district authorities, however, the amount may be raised to 4½ per cent. in all for special trade funds, and may be graduated for different classes of workmen. Workpeople not in any organized employment come upon the communal fund, which is expressly devised to accommodate persons in irregular employment. The relation between receipts and expenses must be readjusted annually; and if the balance is found to be on the wrong side, the contributions are either raised or the benefits diminished, or *vice versâ*. Every fund is obliged to maintain a reserve equal to one-tenth of the annual contributions, or to one year's average expenditure. The latest return showed a membership of the different funds of 7,723,000. This is altogether apart from purely accident insurance, the cost of which is borne by the employers collectively.

The scale of accident relief is fixed as follows, inclusive of medical attendance and remedies: For the first thirteen weeks after the accident, the injured person remains a charge upon the fund to which he subscribes, according to the sick insurance laws; but from the fourteenth week onward the accident insurance funds must provide the required medical aid, and pay the injured workman, if totally disabled, a daily allowance equal to two-thirds of his average daily earnings. Cases of partial disablement are paid according to the discretion of the association responsible. In the event of death, the sufferer's representatives receive a sum equal to twenty days' pay for funeral expenses; the widow, until re-marriage, is given an allowance equal to 20 per cent. of her husband's earnings, with an additional 15 per cent. for every child under 15 who has lost one parent, and 20 per cent. if it has lost both. Other relations entirely dependent upon the deceased receive an allowance equal to 20 per cent. of his wages. The allowances made to widow and children must not exceed 60 per cent. of the wages of the deceased. These payments are made through the Post Office, which receives repayment from the associations at the end of five months.

The contributions payable by the members of the different associations vary in proportion to the degree of risk attaching to the industry. Inasmuch as the expenses include the costs of investigation, arbitration courts, accident prevention, and current administration, the experiment is a heavy charge upon the more hazardous trades; and it has been found necessary since 1890 to increase the contributions paid by the employers. It will be specially interesting to our readers to know that, in a table showing the classification of industries according to cost of insurance and risk, the entry for "gas and water works" stands nineteenth of a total of thirty-four. The entire cost of insurance, including compensation and administration, stands in this case at 0·923 per cent. of the wages paid. The total amount paid in compensation is 0·41 per cent. of the wages; and the ratio of fatal accidents is 0·065 per cent., while that of accidents of all kinds for which compensation was paid is 0·38 per cent. of the number insured. In another table it is shown that these data apply to 1138 establishments, with 26,873 possible beneficiaries. There were 463 accidents compensated in 1891, including claims standing over from previous years.

There remains the third order of compulsory German workmen's insurance funds to be noticed—that against inability to work consequent upon old age or permanent invalidity. The first scheme of this kind was drawn up by the Imperial Insurance Office in 1887; and the existing law on the subject came into operation only in 1891. Its scope is greater than that of the other insurance laws; for it includes all persons over sixteen years of age engaged in any industrial pursuit, and receiving pecuniary remuneration. In the first place, therefore, this insurance was intended for all persons who are dependent upon employment by others for their means of subsistence; but, in addition to these, persons who carry on an independent business without employing any paid workmen, and small employers, who are practically workmen, have the option of insurance, or may even be compelled to insure themselves at the discretion of the Federal Council. There still remains much uncertainty in detail as to the persons to be included under the law; but the work of the mechanic is the type to which all employment involving insurance is supposed to approximate. In organizing the new system of insurance against old age and invalidity, the greatest care was taken by the Imperial Government to avoid over-centralization. While the Federal Council and the Imperial Insurance Office are the supreme legislative and executive authorities, the actual administration of the law is left to district Insurance Institutes, to the number of thirty-one in all. Each division has a paid executive board and a committee. The former contains an official element; while employers and employed are equally represented on the committee, which is elected by the committees of the friendly societies and sick insurance funds in the district. Thus one organization of the kind is made useful in starting another. It would occupy too much space to explain the safeguards under which these societies work.

The benefits secured to the insured persons include an allowance during invalidity and old age; and in the case of persons not subject to the sick insurance laws, medical care during sickness, with a view to preventing permanent invalidity. For insurance purposes, all German workmen are divided into four wage classes—those earning less than 350 marks per annum, those earning from 350 to 550 marks, those earning from 550

to 850 marks, and those whose annual earnings exceed 850 marks. The members of the different classes pay premiums calculated on a graduated scale, which ranges from 2 pf., or about ¼d., a week for the poorest, to 13 pf., or about 1½d., a week for the highest class. To obtain an invalid pension it is necessary to have been a subscriber to the fund for five contributory years—a contributory year being reckoned as 47 weeks, leaving a margin of five weeks for want of employment or other contingencies. The term of subscription for an old-age pension is thirty years; but the payments may be to a certain extent intermittent in either case. Although a good deal of ingenuity is displayed by the framers of these regulations, the net result is hardly satisfactory. It was never the intention to provide a competence for aged and invalid persons; but it would appear that the scale of relief is inadequate, and that the computations upon which the scheme was floated need correction. The law has scarcely been long enough in force to admit of the preparation of complete statistics relating to its operation; but already certain incidental difficulties, both of a financial and of an administrative character, have made their appearance. In its present form, moreover, the statute affords an almost endless number of openings for litigation, and the machinery for dealing with these disputes appears to Mr. Drage to be needlessly cumbrous and expensive. The labour and trouble thrown upon employers in the matter of making the necessary payments, which is done by sticking stamps on cards, is very great; and the working of the law will increase the already large staff of officials. Public opinion in Germany is reported to be unfavourable to the law, as it at present stands, although the admitted necessity for something of the kind prevails with the public to give the experiment a longer trial before passing a final judgment. Employers complain bitterly of the trouble and expense entailed upon them by the three kinds of insurance; while the workmen regard the scheme with distrust, if not with active hostility. The effect of these arrangements on the rate of wages, the price of commodities, and poor relief has not had time to show itself.

Among the other matters dealt with by Mr. Drage in this report is the municipal employment of labour. It is recorded in this connection that, of the 44 largest towns in Germany, 29 own their own gas-works, which is a movement that appears to meet with the warm approval of the reporter. This useful Blue-book contains much miscellaneous information which cannot properly be discussed in these columns, but which even gas engineers, in common with other employers of labour, would do well to have at hand.

Royal Institution.—The arrangements for lectures to be delivered at this Institution before Easter next include six lectures by Lord Rayleigh on "Light," with special reference to the optical discoveries of Newton. At the Friday evening meetings, which will commence on the 19th prox., one of the discourses will be by Professor Dewar, on the subject of "The Scientific Uses of Liquid Nitrogen and Air."

Death of Mr. A. Leslie, M.Inst.C.E.—The death is announced of Mr. Alexander Leslie, M.Inst.C.E., F.R.S.E., of the firm of Messrs. J. and A. Leslie and Reid, which took place in Edinburgh last Thursday, as the result of an attack of influenza. Mr. Leslie was the son of the late Mr. James Leslie, the founder of the business, who was one of the leading Engineers in Scotland in his day. The firm have been the Engineers to the Edinburgh and District Water Trust since its institution. They were largely consulted in connection with water-works construction, of which they made a speciality. Mr. Alexander Leslie joined the firm in 1870, and took a large part in the introduction of the Moorfoot water supply to Edinburgh. Since 1889, when his father died, he had been the head of the establishment. Last year he was President of the Royal Scottish Society of Arts, and only a few weeks ago delivered his retiring address. Mr. R. C. Reid is now the sole member of the firm.

Death of Mr. D. A. Graham, of Dunedin.—We regret to record the death, on Oct. 14 last, after a protracted illness, of Mr. David Allan Graham, who for about ten years held the position of Gas Engineer to the Dunedin (N.Z.) Corporation. Deceased was born at St. Andrews, Fifeshire, in 1841, and served an apprenticeship in Dundee to the mechanical engineering trade. He, however, displayed a predilection for chemistry and mathematics; and, with the view of studying these branches of science, he attended courses at the St. Andrews and Glasgow Universities. These studies qualified him for the positions in connection with the gas industry which he ultimately filled. He was at one time Engineer and Manager of the Stalybridge Gas-Works. The late Mr. Graham devoted much attention to the study of the commercial valuation of coals and cannels, on which subject he contributed a series of articles to the JOURNAL about twenty years ago; and they formed the basis of a work by him which Messrs. E. and F. N. Spon published in 1882. In that year he went to New Zealand to take up the duties which failing health compelled him to temporarily relinquish in April last, in order to avail himself of the six months leave of absence granted to him; but he was never able to resume them. Mr. Graham married after his arrival in the colony; and he leaves a widow and two children.

NOTES.

The Best Preservative Paint for Ironwork.

Mr. W. Thomson recently read a paper before the Manchester Association of Engineers, on "The Influence of Some Chemical Agents in Producing Injury to Iron and Steel," in which reference was made to the effects of different paints and varnishes used for the preservation of structural iron and steel from rust. From experiments made by himself, Mr. Thomson has arrived at the conclusion that red-lead paint is the best preservative. This result had struck him as remarkable, because red lead is a highly oxidizing substance; but the reason was found to be that the red lead had the effect of producing a skin of the unoxidizable and protective black or magnetic oxide on the iron itself under the paint. The author has also found that other oxidizing agents, such as manganese dioxide, form a paint which preserves iron from rusting; and this discovery he regards as of great industrial importance. Mr. Thomson explained that, having been required some time ago to make a considerable number of experiments to ascertain the most suitable paint for protecting a large iron structure from the action of sea-water spray and rain, he arrived at the conclusion that red-lead paint was the best he could find for the purpose. Mr. John West, a Vice-President of the Society, who presided on the occasion of the reading of the paper, supported the statements and views of Mr. Thomson that red lead is the best preservative paint for ironwork. The chief novelty brought out in the paper was the reason why red lead is so efficient in protecting iron.

The Source of Atmospheric Oxygen.

Dr. T. L. Phipson continues from time to time his interesting communications to the *Chemical News* respecting the vegetable origin of atmospheric oxygen. In his earlier papers upon this subject, mentioned in these columns at the time, Dr. Phipson endeavoured to show that in the primeval ages of the earth, when life first made its appearance, plants must have preceded animals, as the presence of unoxidized substances in the primitive rocks goes to prove that oxygen was not a constituent of the primitive atmosphere. On account of its feeble affinities, nitrogen alone could have formed the atmosphere in the earliest ages of our planet's history; and previous to the advent of life, this primitive atmosphere was charged with carbonic acid and vapour by volcanic action. Hence the first vegetation of the globe developed in an atmosphere devoid of free oxygen, but composed of nitrogen, carbonic acid, and water; and the whole of the oxygen now present in the earth's atmosphere is due to vegetation, extending over immense periods of time. Dr. Phipson has proved experimentally that the plants of the present day are essentially of the same nature as the primeval kinds, only they have become accustomed to the changed conditions. He thinks that the precise geological period at which oxygen became present in the earth's atmosphere in sufficient quantity to support animal life, will never be determined, because the change must have been very gradual. Dr. Phipson's latest paper describes the successful cultivation of the common wild convolvulus in what he calls the primitive atmosphere contained in a graduated tube. In the course of 98 days, the plant had converted nearly all the carbonic acid into oxygen—leaving the nitrogen exactly as it was at the commencement of the experiment; and the atmosphere in the tube was richer in oxygen than ordinary atmospheric air.

The Nomenclature of Radiant Energy.

Mr. Simon Newcomb has written to *Nature* proposing that the use of the term "light" to designate ethereal waves having a length between certain definite limits, shall be discontinued, as being unscientific. He remarks that the general understanding and application of the now received theory of ethereal wave effects, which recognizes in this form of energy no differences of kind except wave-length, has been materially retarded by the want of a corresponding nomenclature. It is suggested that the ordinary way of speaking of these effects has come down from the time when it was supposed that there were three distinct kinds of rays in the spectrum—severally known as light, heat, and actinic rays. After various attempts, Mr. Newcomb hit upon the very simple term "radiance," as one which seems well fitted to supply the want in question. He proceeds to argue for the use of the word "illuminate" to signify the throwing of radiance upon a material body, although he admits that, in ordinary language, it implies light. Then a transparent or a diathermanous body would be called a "transradiant;" and the proper measure of radiance would be "the amount of energy radiated in unit time;" but how the different forms of radiance may be distinguished does not appear from the communication.

The Temperature of Baking Bread.

There is proverbially said to be "reason in the roasting of eggs;" and it is incontestable that there is science in the baking of bread. Only recently M. Balland brought the latter subject under the notice of the Académie des Sciences, in a communication regarding the interior temperature of bread upon leaving the oven. M. Balland stated that experiments made with various ovens and on different-sized loaves show that the temperature of the crumb during baking attains 100° to 102° C. That of the crust, which could not be formed at this temperature, is much higher. Above 100° C., the vapour of

water confined by the formation of the crust attains a degree of pressure. When this pressure is lost by reason of cracks in the crust, which was the case in the trials carried out by M. Balland, the interior temperature of the loaf does not exceed 100° C. At a later meeting of the Académie, M. Aimé Girard referred to this statement of M. Balland, and stated that he had always indicated 101° C. as the normal temperature to which bread is raised in the oven, when the baking is satisfactory.

Society of Engineers.—At the meeting of this Society on Monday evening last week—Mr. W. A. Valon, J.P. (the President), in the chair—the paper read was on "Some Practical Examples of Blasting;" the author being Mr. Perry F. Nursey, one of the Past-Presidents of the Society.

Death of Mr. David Mason, of Leyland.—Mr. David Mason, Resident Engineer at the Leyland Local Board Water-Works, died on Friday last, at his residence, Whittle-le-Wood, at the age of 45. Deceased, who had held the position since the water-works were established, succumbed to heart disease.

The Production of Petroleum in Russia.—The Russian *Novoe Vremya* has lately devoted an article to the subject of petroleum production in Russia. It seeks to prove that this branch of industry has not progressed properly; and that sufficient benefit is not reaped from the extraction of the product—the quantity of petroleum produced being in disproportion with the quantity of naphtha used. It shows that in four years the extraction of naphtha and the production of petroleum at Baku have been as follows: Extraction of naphtha—1889, 205,000,000 pouds; 1890, 239,000,000 pouds; 1891, 288,000,000 pouds; and 1892, 298,000,000 pouds. Production of petroleum—1889, 61,100,000 pouds; 1890, 67,300,000 pouds; 1891, 74,000,000 pouds; and 1892, 78,700,000 pouds. From these figures it appears that in 1889 29·8 per cent. of the quantity of naphtha was extracted; in 1890, 28 per cent.; in 1891, 25·7 per cent.; and in 1892, 26·4 per cent. With respect to the small proportion of petroleum extracted from the raw material, this results from the very nature of the Caucasian naphtha. Experiments made twelve years ago proved that, while American naphtha gave 75 per cent. of material capable of use for lighting, Russian only yielded 30 per cent.—at least, such as is employed in lamps.

Oil-Engines.—At the second meeting of the Association of Birmingham Students of the Institution of Civil Engineers, which took place on the 30th ult., under the presidency of Mr. C. Hunt, M.Inst.C.E., a paper on "Oil-Engines" was read by Mr. Harry M. Waynforth, Assoc.M.Inst.C.E. The author mentioned the various petroleum oils at present used for motive purposes. He gave details as to specific gravity, flashing-point, and price; divided oils into classes—the dangerous oils, intermediate oils, lubricating oil, and refuse; and explained how these would be obtained from crude petroleum. The various oil-engines of to-day were next noticed; the special features and advantages claimed in each case being emphasized, and copies of indicator diagrams, particulars of consumption of oil, and the average cost of running per brake horse power per hour given in each case. The various plans of introducing the charge to the cylinder, and the ignition of the charge, were explained. The methods of governing adopted were compared; special points being dwelt on, together with the comparative costs of steam, gas, and oil engines. In conclusion, the author pointed out some of the uses to which oil-engines are now put, and some possibilities regarding their future employment. The paper was illustrated by limelight views, specimens of petroleum oils, drawings, and photographs; and a discussion followed.

Death of Mr. Bryan Donkin.—We regret to record the death, on the 4th inst., in his 85th year, of Mr. Bryan Donkin, M.Inst.C.E. Deceased was the fifth son of Mr. Bryan Donkin, F.R.S., of Bermondsey, the originator of the first practical continuous paper machine; and at an early age he was apprenticed to his father at his engineering works. There he took an active part in designing, superintending, and assisting in the construction of paper, printing, and other machinery; and he came in contact with many of the notable engineers of his day—among others, Mr. I. K. Brunel, Sir H. Bessemer, Mr. J. Penn, Mr. Maudslay, Mr. Hall, Mr. Bramah, and Mr. Farey. After his father's death, he became a partner in the Bermondsey works—first with his brothers, John and Thomas, and Mr. Farey; and later with his nephews, Mr. Bryan Donkin, jun., and Mr. E. B. Donkin. During his connection with the firm, a very large quantity of gas machinery and some hundreds of exhausters were constructed; and the reputation achieved in this department of engineering has been maintained and extended. During his business career, reaching over a period of fifty years, he took out several patents connected with paper machinery and steam-engines. He displayed great energy and tact; and, under his vigorous supervision, and that of his partners, the works at Bermondsey were considerably increased in size. He throughout had a kind and genial disposition, which was much appreciated by his employees and those who knew him. He retired from active business about the year 1881. His connection with the Institution of Civil Engineers commenced in 1835, when he was elected an associate; and five years later he was transferred to the class of members. By seniority, he was the "father" of the Institution. The funeral took place on Friday last, at Nunhead Cemetery.

TECHNICAL RECORD.

INSTITUTION OF CIVIL ENGINEERS.

Indian Water-Works and the Design of Masonry Dams.

At the Meeting of the Institution of Civil Engineers on Nov. 21, four communications were read dealing with the subjects of impounding reservoirs in India and the design of masonry dams.

The first paper was on "The Tansa Works for the Water Supply of Bombay;" the author being Mr. W. J. B. Clerke, B.A., C.I.E., M.Inst.C.E. After referring to previous accounts of the Bombay water supply, the author gave a general outline of the present extended works, and proceeded to describe in detail the principal feature of the scheme—viz., the masonry dam at Tansa. At a distance of 57 miles from Bombay, a storeage reservoir has been constructed in the Tansa Valley, capable of impounding, after all deductions, 31 million gallons of water daily for 365 days; and as the waste weir runs for at least three months in the year, the actual quantity available will be 41 million gallons per day for a population of 821,764. Should this quantity ever become insufficient, the dam has been so designed that it can be raised to a height which will double the capacity of the lake. The section of the dam has been designed according to the methods advanced by M. Bouvier, of the French Service of Roads and Bridges; and, while fulfilling all requirements of stability, it is economical as regards material. The geological formation of the rock basin of the Tansa Valley is amygdaloid trap; but at the site of the dam this is partly overlaid by a mass of crystalline basalt, intersected by veins of soft material, which necessitated the foundations being carried in some places 30 feet below the level of the rock, in order to reach the trap. This entailed a heavy outlay; but the author stated that the result had been satisfactory, as the foundations were quite water-tight. The dam was constructed of uncoursed rubble masonry throughout. Anything approaching regular horizontal joints was carefully avoided; and pains were taken to preserve a good bond throughout the whole breadth of the work. The greater part of the stones used did not average more than ½ cubic foot in bulk. Every stone was laid full in mortar; each one being selected so as to roughly fit the place in which it was to be laid. It was then driven home in its bedding of mortar by blows from a light mallet, and all spaces between it and the adjoining stones were filled flush with mortar. Spalls or small stones were inserted in the mortar between the joints. Occasionally, where convenient, large masses of stone were placed in the body of the work; each mass being bedded in mortar, and built round with rubble masonry. But this system was only used for an insignificant portion of the work. Great care was taken, by close supervision, to prevent, as far as possible, any dry work or hollow spaces occurring in the masonry. There was no ashlar in the faces, though the surface stones had to be roughly faced with the hammer to preserve the outline of the profile. Kunkur lime, mixed with sand of disintegrated trap-rock, obtained from the beds of the rivers near the works, was used for the mortar. The total quantity of masonry in the dam was 11 million cubic feet. The aqueduct between the reservoir and Bombay consists partly of conduits of rubble masonry, partly of tunnelling, and partly of cast-iron pipes. The syphons used in crossing valleys are 48 inches in diameter, and 1⅛ or 1⅜ inches thick, according to the maximum head imposed upon them. The stop-valves are of the Glenfield Company's pattern, with two shutters. The whole of the pipes for the work, amounting to 48,000 tons, were manufactured in Glasgow. Each pipe was tested with oil in the manufactory to a pressure of 200 lbs. per square inch. The cost was £5 15s. 8d. per ton, delivered at Bassein Creek. The total cost of the works was Rs.149,50,000.

The second paper was on "The Baroda Water-Works," by Mr. Jagannath Sadasewjee, Assoc.M.Inst.C.E. The city of Baroda, containing a population of about 120,000, was formerly dependent for its water supply upon tanks and wells in the immediate vicinity. Shortly after the accession of the present Gaikwar, the author proposed that water should be obtained from the River Surya, lying within His Highness's territory. The undertaking involved the construction of an impounding reservoir 12 miles north-east of Baroda, and a 30-inch cast-iron main, settling-tanks, and purification works; also a covered service reservoir and distribution works. The scheme was designed to supply 3 million gallons of water daily. The catchment area of Lake Sayaji (as the impounding reservoir has been named) is 36·2 square miles; the water-spread at the top water-level being 4·72 square miles. The mean rainfall for seventeen years was 39 inches; and that for three consecutive dry years, 33 inches. The loss by evaporation from the reservoir was assumed to be 72 inches annually. The reservoir was formed by an earthen embankment across the River Surya, 14,400 feet in length, and 54 feet in maximum height, storing 8018 million gallons of water. The top breadth, which is uniform throughout, is 15 feet. The outer slope of the bank was built at an inclination of 2 : 1; the inner slope, which was faced with pitching of dry bricks 9 inches thick, was inclined 3 : 1. There was no puddle wall in the embankment—the material employed

being of good quality; but one was carried through the natural ground beneath it, along its entire course. Subsequently a second puddle wall was put in at a distance of 150 feet from the inner toe of the bank, to prevent underground percolation. The waste-water course has a clear width of 800 feet, and is excavated through the elevated ground forming the north boundary of the reservoir. The draw-off and scour valves are contained in a tower connected with the lake by two plug-valves. From the interior of the tower the water passes into a 30-inch cast-iron main controlled by a sluice-valve. From the valve-house at the foot of the embankment a cast-iron main, also 30 inches in diameter, was laid parallel to the road from Ajiva to Baroda. The length of main from the valve-tower to the Mandvi Tower is 12½ miles. It is provided with twelve stop-valves and twelve ball air-valves, at regular distances of one mile; and six scour-valves have been placed in convenient situations for furnishing water to certain villages in times of scarcity. The supply from the Surya River is not altogether satisfactory; and it is intended to supplement these works by throwing an earthen dam across the Vishwamitri River, to form a lake at the village of Asoj, and to cut a canal about 4 miles in length to feed the Sayaji Lake.

The third paper was on "The Water Supply of Jeypore, Rajputana," by Colonel S. S. Jacob, C.I.E., Assoc.Inst.C.E. The author described the water service of the city previous to 1873, when, after an exhaustive inquiry, it was decided to obtain a supply from the Amani Shah Nullah, the water of which had been pronounced to be of excellent quality. A weir was made across the bed of the Nullah on the site of a dam formerly existing. Pumping machinery was erected, and a supply of 36,000 gallons per hour was obtained. These works were completed in 1879, and fulfilled their purpose until May or June, 1881, when the water in the stream was only just sufficient to meet the increased demand. The fact that during the rains a large volume of water flowed away, suggested its storeage for use during the hot weather; but, in order to accomplish this, it was necessary that a dam should be completed in one season between the rains. A site was selected, 750 feet above the pumping-station, where 922 million gallons of water could be impounded from a drainage area of about 13 square miles. The mean rainfall was 24 inches; but, owing to the nature of the soil, it was considered that not more than 4 inches, or about 748 million gallons, would flow off annually. After the embankment had been made, it was found that only 1-60th part of the rainfall flowed off the catchment area into the reservoir. The author remarked that the embankment possessed some interest, inasmuch as it had no puddle wall, and was made of sand, resting upon sand and mud—the natural surface being merely dug up, and the coarse grass roots removed. Work was begun on June 27, 1884. Sidings of light rails were laid down on each bank, with a slight incline. Two men were placed in charge of each waggon, which, after being filled, was pushed along, and soon acquired sufficient momentum to run on to the site of the bank, carrying both the earth and the men, who jumped on to the waggon after starting it. As the embankment rose, the rails were also raised; and the speed and economy with which the work was done were highly satisfactory. As many as 129 waggons were at one time employed; bringing some 30,000 cubic feet of sand daily from a distance of about 1000 feet, at half the cost of manual labour. Extra men were employed to spread and ram the earth; and morning and evening a few Raj elephants walked backwards and forwards over the work, to consolidate it. A temporary outlet, consisting of two 12-inch sluices, was built 5 feet above the river bed at one side; and the Nullah was closed on the 26th of October, with the object of impounding as much water as possible for the ensuing hot season. In the meantime, the permanent outlet-well and culvert were taken in hand; the former being of masonry. Wing walls were provided on the water side, with cross walls to counteract any thrust. In the cross walls there were large openings, over which moveable iron gratings were fixed. The water passed through these gratings to two 12-inch outlet-valves, worked from cast-iron pillars on the top of the wall. The outlet-culvert was of masonry, 7 feet wide and 7½ feet high. To prevent water creeping along the culvert, slabs of sandstone, 3 or 4 inches thick and about 8 feet long, were built in the masonry, and projecting 6 feet all round it, forming collars at every 50 feet along the length of the culvert, against which the earth was well rammed. Special measures were taken to prevent leakage at the toe of the outer slope. Next the earth a layer of sharp sand about 10 feet wide and 5 feet deep was placed; outside this a similar layer of small broken stone; and finally a similar mass of large rubble. The work was completed in September, 1885, at a cost of Rs. 9,97,609. The greatest flood occurred on Aug. 1, 1885, when the water rose 5 ft. 10 in. in 24 hours. The highest level yet attained by the water has been 31½ feet.

The last paper read was "On the Design of Masonry Dams," by Professor Franz Kreuter, of Munich. The author proposed to show how, by dividing the problem into several distinct parts, and by introducing certain limitations and suppositions, a mathematical solution as exact as desired might be arrived at, without employing the system of trials and tedious calculations generally thought necessary. According to De Sazilly, Graeff and Delocre, Krantz, Rankine, and others—to whose labours is due the idea of giving to the cross-sections of masonry dams a shape of uniform stability and strength—the basis of a sound theory of these structures is: (1) That at any horizontal section the intensity of pressure at the faces of the wall should never exceed a certain value fixed upon as the safe crushing load of the material of the dam. (2) That at no horizontal layer of the masonry should there be any danger of sliding. (3) That at those parts of the profile where the wall has a batter, the intensity of pressure at the faces should be diminished below the limits answering to vertical faces. (4) That there ought to be no practically appreciable tension in any part of the masonry, whether at the outer face when the reservoir is empty, or at the inner face when it is full. The lines of resistance, therefore, should not deviate from the middle of the thickness of the wall to an extent exceeding one-sixth of the thickness. Adhering to these principles, the author made the following assumptions: (*a*) The water-level was supposed to reach to the top of the wall; (*b*) the vertical component of the water pressure upon the battered part of the inner face of the wall was provisionally neglected; (*c*) the shearing stresses acting parallel to the layers of the wall were not allowed for. The effect of these limitations was explained; and the author proceeded to consider the primary shape of the cross section. The simplest form was, he said, a right-angled triangle with a vertical inner face. This form, however, could not be realized in practice, owing to the necessity for giving a certain width to the top of the wall, which often had to be sufficient to form a road. The upper part of the wall was frequently a rectangular block of masonry; and where it was not so, it might be represented, for the purposes of the design, by a block equivalent to the actual structure. But if such a superstructure were placed upon the triangular dam, the lines of resistance would be displaced throughout the whole body of the dam. It was therefore necessary to depart from the triangular cross section; and among the elements determining the cross section to be sought for would be the mass and the form of the superstructure. This necessity was met by dividing the wall into three parts, to which different methods were applied—viz., the rectangular superstructure; the body of the wall with vertical inner and curved outer face; and the lowest portion, or base, of the wall with both faces curved. The author maintained that this division of the subject, due to Delocre, was incomplete, because, if the same conditions of stability were made to apply throughout, there would be a discontinuity at the plane of junction of the portions (1) and (2). He consequently introduced between those portions another, to which the condition of (1) would apply at its upper limit, and those of (2) at its lower limit. His investigation was therefore divided into four parts, treating respectively of the four portions of the wall to which different conditions had to be applied. These portions were considered analytically; and, to exemplify the method described, a resultant cross section was developed, applicable, in accordance with the author's theory, to the conditions of the well-known masonry dam of Furens.

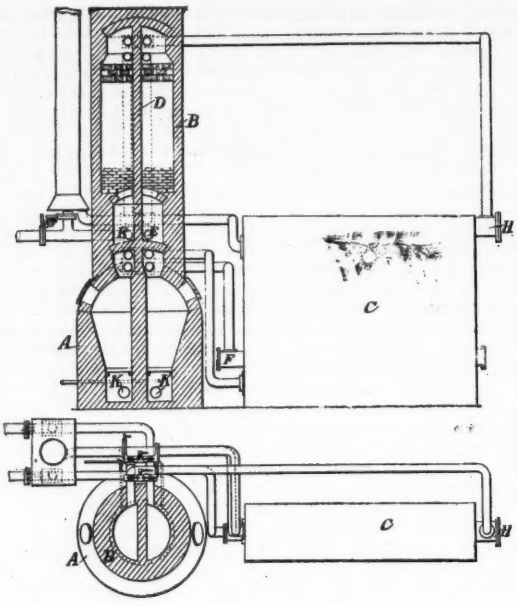
REGISTER OF PATENTS.

Manufacture of Gas and Bye-Products from Liquid Hydrocarbons.
Dvorkovitz, P., of Canonbury, N. No. 21,647; Nov. 26, 1892.

This invention relates to the manufacture of gas and bye-products—such as benzol, toluol, and the like—from liquid hydrocarbons, wherein internal heating of the fixing chamber for gasifying the hydrocarbon is resorted to. Such apparatus is described in patents No. 17,150 of 1890 and No. 19,641 of 1891 (granted to T. G. Springer, of Chicago); but the invention is not limited in its application to that apparatus. Its principal object is "to obviate objections to the use of such apparatus arising principally from the large quantity of fuel required to heat it, and from the loss of valuable bye-products owing to the large amount of air which enters the fixing chamber or cupola in which the gases are fixed, and the waste of gas and objectionable flames due to the burning of the gas which is left in the fixing chamber after each operation, and further to prevent the injury to the outlet-valves, and consequently their capability of closing tightly."

The fixing chamber or cupola, and also the generator (from which the heat is obtained, and in which the water gas is produced), is divided by a partition into two or more compartments, so as to reduce the space in the chamber in which air and gases after each operation are contained; also, by arranging passages and sets of valves corresponding to the number of compartments formed, the operation can be carried on continuously, as one compartment can be in operation whilst the others are out of use. The liquid hydrocarbon and water gas pass through a gasifier, arranged as described in patent No. 7983 of 1892; the gasifier being heated by the otherwise wasted heat from the generator, by leading the products of combustion therefrom to the gasifier. In this arrangement, the fixing chamber or cupola is kept at a much lower temperature than in Springer's arrangement, as it is possible to "blow up" to heat the apparatus from the generator and pass the products of combustion from the generator through the gasifier, and then down the fixing chamber or cupola, and therefrom to an outlet in a chimney which conceals the flame of the gases which were left in the fixing chamber or cupola, and which burn at the outlet. Owing to the heat of the fixing chamber or cupola being thus lowered, the gasification or destruction of valuable bye-products is prevented, such as are destroyed by the high heat of the fixing chamber or cupola worked in Springer's arrangement.

A [next page] is the furnace or generator, where steam is decomposed to produce water gas. Above the furnace is a cupola or fixing chamber B, through which the water gas, after passing through a gasifier C, is



caused to pass on its way to the condenser. The furnace and the fixing chamber are each divided by a partition D into two compartments, connected by pipes or passages and valves with a pipe or passage leading to the lower part of the gasifier. This gasifier is heated by the products of combustion from the furnace or generator. These heated products enter the gasifier at the lower part thereof; and after circulating round the tubes therein, pass out at the upper end, and are conducted thence either direct to the chimney or (by means of valves) into one or other of the compartments of the fixing chamber. Thence they pass, by one or other of two pipes or passages E and valve, to the chimney. The fixing chamber may thus be heated to the required degree by means of what would otherwise be waste products of combustion from the furnace. The furnace or generator is in communication by pipes and valves with a passage leading to a chamber F in the gasifier, in which the water gas generated in the furnace or generator becomes carburetted by hydrocarbon, vaporized in the tubes in the gasifier, as described in patent No. 7983 of 1892. The carburetted gas passes from the gasifier at H, and is conducted into the upper end of one or other of the compartments of the fixing chamber B; and, passing down through the reticulated brickwork therein, finds an exit into a pipe or passage leading to the place of consumption, or to a condenser or holder, or other apparatus.

The vapours or gases of the liquid hydrocarbon in the gasifier can be drawn out from the gasifier by an exhauster, which delivers them so that they meet the water gas at such a pressure as to prevent the water gas forcing the vapours or gases back into the gasifier, and thus obviate all possible danger of the gasification or destruction of highly valuable bye-products.

In working the apparatus, the two compartments of the generator are charged with coke and lighted; air under pressure being then admitted into one of the compartments through the pipe K, the valves being adjusted so as to establish communication between the compartment in use and the gasifier, so that the heated products of combustion from the compartment will enter the gasifier and heat the vaporizing-pipes therein. When the coke has been raised to the required temperature, the supply of air is discontinued and the valve closed, so as to cut off communication. At the same time, the valve is opened to establish communication between the gasifier and the other compartment of the generator. Steam is then admitted to the first compartment, and the valve opened, to establish communication between this compartment and the carburetting chamber in the gasifier. Liquid hydrocarbon is also admitted to the interior of the tubes of the gasifier, which tubes, being heated by the products of combustion from the furnace, effect the vaporization of the hydrocarbon—the vapour becoming intimately incorporated with the water gas in the carburetting chamber, whilst the heavy tar is deposited in the chamber, and may be withdrawn as required. The carburetted water gas, on passing from the gasifier C at H, is conducted into one compartment of the fixing chamber, wherein those constituents of the carburetted gas which it is desired shall be converted into illuminating gas are rendered permanent; whilst bye-products—such as benzol, toluol, and the like—deposit in the compartment, and can be removed as required. The permanent gas passes out of the compartment through the pipe or passage E, and is conducted to a holder or other apparatus.

While steam is being decomposed in the first compartment of the generator, the coke in the other compartment is being "blown up" or raised in temperature by the air admitted; the heated products of combustion passing from this compartment into the lower part of the gasifier, so as to maintain the vaporizing-tubes at the required temperature. When the coke in the first compartment has cooled down, the supply of steam thereto is discontinued, and steam is introduced into the second compartment; the valves being adjusted so as to close the passage for gas from No. 1 compartment to the gasifier, and open communication between the gasifier and compartment No. 2, for the passage of the gas from the compartment into the carburetting chamber of the gasifier. Here it mixes with the hydrocarbon vapour, and passes into a pipe by which it is conducted into the upper end of the second compartment of the fixing chamber. It then passes down through the reticulated brickwork, and out through the passage to a condenser or other apparatus.

Ascertaining the Volume of a Particular Gas in a Gaseous Mixture, and Ascertaining the Weight of Gases.—Arndt, M., of Aachen, Germany. No. 23,876; Dec. 27, 1892.

This invention relates to apparatus in which a gas-balance, provided with a gas-container open at bottom, is enclosed in an air-tight casing, through which the gases to be weighed (or of which a portion is to be measured) are drawn, thereby operating without resistance, and therefore with great sensitiveness. A hollow vessel is fixed underneath the gas-container, into which a gas supply-pipe is led; the different parts being so located that, upon the oscillation of the balance-beam, and therewith the gas-container, this latter may move freely up and down without coming in contact with it. The casing has an inlet for the gas proceeding to the container, and an outlet for the gas passing from the container, with glass for the purpose of observation, and suitable air-tight doors or plugs for access to the apparatus, admission of air, &c. The gases are drawn slowly through the apparatus by suction apparatus, by which also the air in the casing is rarefied. A pointer on the balance-beam indicates on a scale either units of weight or a particular percentage volume of a certain gas in a gaseous mixture—for instance, the volume of carbonic acid in smoke gas. The fluctuations in the volume of the gases taking place within the gas-container, by reason of the up-and-down motion of this latter, are kept in view on the scale. The gas-container carried at one end of the beam is balanced by a compensating vessel, also open at bottom, at the other end of the beam, or by weights.

Manufacture of Sulphate of Ammonia.—Spence, F. M. and D. D., and Sisson, G., of Manchester. No. 92; Jan. 3, 1893.

This invention relates to the treatment of ammoniacal liquor from gas or other works, for the production of sulphate and other salts of ammonia, by using hot waste liquor from the still in which the ammoniacal liquor is distilled, for the slaking and mixing into a "milk" of the lime to be employed in such treatment.

The specification (which is not illustrated) is as follows: "In the manufacture of sulphate and other salts of ammonia from ammoniacal liquor, lime is used to drive off from such liquor the "fixed" ammonia contained therein, and the lime is usually slaked and mixed with water before being added to the liquor. Our invention consists in using a portion of the waste liquor from the still in which the ammoniacal liquor is distilled, instead of water, for the slaking and mixing of the lime. We prefer to do this by means of a suitable lime-mixer provided with an agitator; the hot waste liquor as it flows from the still being allowed to run or be pumped into such lime-mixer in sufficient quantity to form milk of lime for use in the still. By means of our invention, the following advantages are obtained: (*a*) The milk of lime produced is introduced hot into the still. Thus a saving of fuel is effected, as less steam is required than when (as hitherto) cold or only slightly warm water is used for slaking and mixing the lime. (*b*) Less waste liquor is produced; and, therefore, less ammonia is lost in the waste liquor. (*c*) Any excess of lime which may be contained in the waste liquor employed is utilized; and thus less lime is required. It is obvious that, when a still is being first put into operation, the milk of lime for use in the treatment of the ammoniacal liquor first supplied to such still will require to be made by the slaking and mixing of lime with water in the usual manner; the application of the invention being possible as soon as any waste liquor is available for use in the slaking and mixing of further quantities of lime, for use in the treatment of further quantities of ammoniacal liquor."

Overhead Regenerative Gas-Lamps.—Collins, I. J., of City Road, E.C. No. 123; Jan. 3, 1893.

In patent No. 19,337 of 1892 is described the construction of an overhead regenerative gas-lamp, arranged especially for use in a railway carriage. When the lamp is so used, says the patentee, it is necessary to get access from the roof of the carriage to the interior for lighting the lamp; and the present invention relates to a modified construction of the upper part of the lamp, so as to give ready access to the interior without involving the lifting of much weight and the consequent risk of fracture. For this purpose, the gas supply-pipe is passed through the wall of the lamp-casing, below the hinge by which the roof part of the casing is jointed to the wall. Then, in opening the lamp, by turning the roof upwards and backwards on its hinge, there is no disturbance of the gas-pipe, nor of the perforated diaphragms and air-passages below the roof. The chimney, which is hinged to the central casting in which the regenerative passages are formed, can be turned up and back from its seating when the roof is turned up on its hinge. In order, however, to save trouble in manipulation, the chimney can be connected to the roof by a chain, so as to be raised from its seating, when the roof is raised. When the chimney in either way is raised from its seating, a light can be passed through one of the passages below the chimney to the burner.

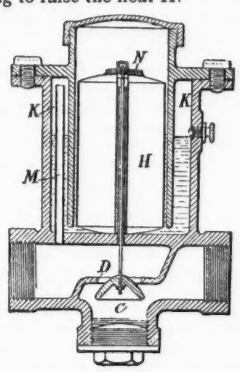
Increasing the Illuminating Power of Common House Gas by Burning the Fumes of Heated Oils in Conjunction with it.—Harrison, C. H., of Shepherd's Bush, London, W. No. 2376; Feb. 3, 1893.

The patentee, who describes himself as a "gas engineer," claims as his invention: "The novelty of largely increasing the illuminating power of common house gas, by combining the same with the fumes of heated oils, in an apparatus, self-working, portable, simple, and that requires recharging with the oil or carburetting material but seldom, and that can be attached to a gas-fitting, or gas-pipe, simply by the use of a screw connection."

There is no drawing attached to the specification of this patent; but, in the language employed by the inventor, its "nature" and the "manner the same is to be performed" is "to be particularly described and ascertained in and by the following statement:" The apparatus preferred for use is "a metal vessel charged with oil. Gas enters the vessel through a tube, and passes through another tube or tubes to gas-burners placed in such positions that the heat from them shall sufficiently heat the oil within the vessel, whereby fumes or vapours are made to rise from the same, which, mixing with the gas, will then pass to the burners, where it will burn with a brilliant flame."

Gas-Regulators.—Defries, M., of Dane's Inn, W.C., and Feeny, V. I., of Queen Victoria Street, E.C. No. 231; Jan. 5, 1893.

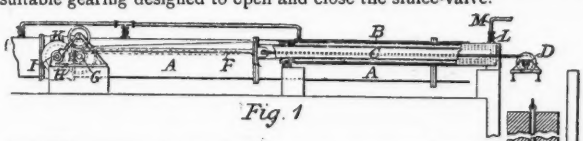
The outlet-pipe of this regulator is made of the same diameter as the inlet; and it extends into a valve-chamber C, formed at the bottom of the regulator, and so closes the inner end of such extension. Upon this extension is the valve-seat D, the total area of which is equal to the bore of the inlet or outlet. The valves are carried by a stem attached to a float H, contained within a cylindrical chamber above the valves, which at its lower end communicates with an outer annular chamber K. These chambers contain water or any suitable liquid—preferably water with a layer of oil on top. Into this outer chamber K, a tube M from the outlet rises above the level of the liquid; and the pressure of the gas conveyed through this tube tends to depress the liquid in the outer chamber, thereby raising the liquid in the inner chamber, and tending to raise the float H.



By adjusting the weight of the float with weights N, the pressure necessary to raise the float can be varied at will. For instance, by weighting the float so that it just touches the bottom of the chamber when no pressure is on, the addition of another weight placed on the top of it will cause it to require a definite minimum pressure before it will rise; and when that pressure is attained, the float beginning to rise carries with it the valves, and contracts the passage for the gas from inlet to outlet.

Automatically Closing Valves on Water-Mains.—Davison, J., of Scotswood-on-Tyne. No. 8914; May 4, 1893.

This invention of automatic valve-closing apparatus, for application to valves on water-mains, consists in the use of a hydraulic ram device, connected to the main by valve-controlled piping, and fitted with a tooth device or rack and with counterweights, adapted to actuate suitable gearing designed to open and close the sluice-valve.



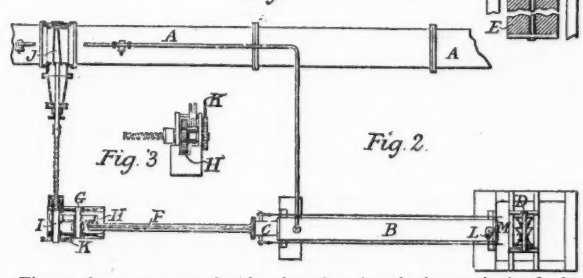


Fig. 1 shows a general side elevation (partly in section) of the apparatus. Fig. 2 is a plan, partly in section. Fig. 3 shows an end view of part of the gearing.

A is the main water-pipe line; B is the ram cylinder; and C, the ram. There are steel ropes connecting the crosshead on the ram with conical rope sheaves mounted on an axle D. On the same axle is a conical sheave, for the rope or chain, which carries the suspended weights E. The steel ropes are so arranged with regard to the sheaves and crosshead that, when the ram is at its outstroke end, the ropes are on the minimum diameter of the scroll sheaves, and the rope or chain attached to the weights is then on the maximum diameter of its scroll sheave. Power is thus gained at the termination of the stroke; but the drawings show the ram at its instroke, with the ropes or chains in the reverse positions to that just described. F is a rack fitted to the outer end of the ram, and gearing with a pinion on an axle G; and the spur-wheel H gears with a pinion on the hollow shaft I. J is a sluice-valve on the main; and the outer end of its spindle is screwed to gear with an internally screwed boss on the shaft I. The rack F is kept in gear with the pinion by a friction-roller, which presses on, or is kept in immediate contiguity to, the lateral flanges of the rack girder. For actuating the valve by hand, should this be found desirable, a hand-gear apparatus is provided, consisting of a worm-wheel on a spindle K, gearing into a toothed wheel mounted on the shaft I.

The operation of the apparatus is as follows: Normally the pressure of the water in the main is allowed to act on the ram, which is thus forced outwards; and the rack F thus turns the pinion and spur H, also the pinion and hollow shaft I and screwed boss, which has the effect of opening the sluice-valve. As long as the pressure in the main remains constant, the valve will thus be kept full open; but if it is desired to actuate the valve or apparatus at any time, this can be done by opening the cock L, which will in consequence reduce the pressure in the ram cylinder, and allow the weights E to actuate the gearing—the water from the ram cylinder passing out through the pipe M. Should a breakage or burst pipe occur in the main, the pressure will be immediately reduced, and the weights will draw in the ram, and, by the action of the rack and gearing, close the main sluice-valve. As soon as the necessary repairs to the main have been effected, the inlet-valve may be slightly opened to admit pressure to the ram, which will thus partially open the sluice-valve. The water passing the sluice will slightly reduce the pressure on the piping and on the ram (it may be below the pressure required to lift the weights); and until the main pipe is refilled or charged, this reduction of pressure will not be fully made up. As soon, however, as the main pipe is fully charged, the normal pressure will be resumed, and the sluice will then be fully opened. Should the reduction of pressure fall below the power required to lift the weights, the sluice will cease opening until the main has been sufficiently charged to produce the requisite pressure to open the sluice; and, in this manner, steadiness in opening the valve is obtained, which, it is claimed, has not hitherto been possible by any other means.

APPLICATIONS FOR LETTERS PATENT.

21,608.—Boyle, J. B., "A motor-cart in which the propelling power is derived from gas or other power." Nov. 13.

21,646.—Glover, J. G., "An improved means for delivering gas from a gas-meter by the insertion of one or more coins." Nov. 14.

21,744.—Wilson, P. J., and Wright, W. E., "Steam, gas, air, water, and other fluid-pressure engines." Nov. 14.

21,765.—Welch, W., "Heating and ventilating gas-burners and appliances." Nov. 15.

21,766.—Allen, J. J., "Regulators for gas and similar taps." Nov. 15.

21,775.—Brunler, O., "Obtaining a compression in gas and petroleum engines with slow combustion." Nov. 15.

21,784.—Eastwood, W. H., "Metallic or combination packing for joints for gas, water, steam, or any other purpose for which a jointing material is required." Nov. 15.

21,796.—Sisson, W., and Holt, R., "Centre-valves for use in connection with gas-purifying apparatus." Nov. 15.

21,804.—Rose, A., "Gas-burner." Nov. 15.

21,967.—Hodgson, J., "Joining wrought-iron pipes, such as are used for gas, water, and steam." Nov. 17.

21,975.—Holbrook, F., "Obtaining a more perfect combustion of, and illuminating power from gas." Nov. 17.

22,061.—Booth, H., "Gas-engines." Nov. 18.

22,071.—Cumming, J. G., "Regulating the light of stair and other gas lamps or burners." Nov. 18.

22,150.—Laurie, W. A., "Lids or covers for gas-retort mouthpieces." Nov. 20.

22,166.—Cowan, W. and W. H., "Prepayment gas-meters." Nov. 20.

22,194.—Clark, F. W., "Carburetting or enriching gas." Nov. 20.

22,231.—Defty, H., "Disseminating and vaporizing oils into gas." Nov. 21.

22,301.—Shapton, W., "Shipping or transferring coal and other materials." Nov. 21.

22,313.—Lallement, L., "Gas-stove." Nov. 21.

22,396.—Langhans, R., "Incandescent bodies for incandescent gas lighting." Nov. 22.

22,411.—Heckert, G., "Lighting of street and other gas-lamps." Nov. 22.

22,492.—Fanta, F., "Manufacture of coal gas by the use of oxygen and hydrocarbons." Nov. 23.

22,525.—Histon, A., and Lawson, R. D., "Gas and oil engines or motors acting by explosive gas." Nov. 24.

22,576.—Marshall, F. D., "Washing and purifying gas." Nov. 24.

22,590.—Ruddock, O. S., "Gas-stoves." Nov. 24.

22,604.—Coleman, T., "Gas-burners." Nov. 25.

22,632.—Fielding, J. A., "Joints of pipes for gas or vapour." Nov. 25.

22,742.—Abel, C. D., "Controlling the supply of combustible fluid to gas and oil motor engines." A communication from the Gas Motoren Fabrik Deutz. Nov. 27.

22,818.—Mork, H., "Holding or supporting devices for gas-pipes and the like." Nov. 28.

22,858.—Orling, E., "Electric lighting and extinguishing apparatus for gas-burners." Nov. 28.

22,908.—Fourness, H., "Hydraulic mains and valves for gas-retorts." Nov. 29.

23,009.—Dixon, T., "Protecting gas-burners and preventing the waste of gas." Nov. 30.

23,075.—Crossley, F. W., and Atkinson, J., "Gas or internal combustion engines." Dec. 1.

23,102.—Wedderburn, J., and Jewell, F., "Automatic coin-freed gas-meters." Dec. 1.

23,196.—Holt, H. P., "Driving gear of gas motor locomotives." A communication from A. Prawatke. Dec. 2.

Completion of a Large Telephonic Scheme for the Liverpool Water-Works.—Telephonic communication has lately been established for the Corporation of Liverpool, connecting the offices of the Water Engineer (Mr. J. Parry, M.Inst.C.E.), in Liverpool, with the water supplies of Lake Vyrnwy (Montgomeryshire), the Rivington reservoirs (Lancashire), and the houses of the reservoir keepers and walksmen along the lines of aqueducts. The work has been carried out to the specification of Mr. Parry, and affords a very ready means of communication between all points of the water supplies. The system is entirely on the metallic circuit principle; and the wires are carried as nearly as possible along the lines of aqueducts. The total distance of lines as laid is something like 115 miles. About 16½ tons of wire has been used on the work, and also 2300 poles and 5000 insulators. There are in all 26 stations connected on the system. In addition to the telephonic communication, there are alarm contacts to valves and for overflows, ringing bells at the nearest signalling station.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Oxy-Oil Gas.

SIR,—In reply to the query in your remarks at the end of my letter, in your issue of this week, it is only necessary for me again to refer you to the text of my paper, as reported in the JOURNAL. There I said: "The plant at Huddersfield is designed to produce 200,000 cubic feet of oxy-oil gas per 24 hours . . . The oxygen plant . . . has been working for some time. It is built in two independent sections, is capable of producing 30,000 cubic feet of oxygen per day . . . The oil plant *will, when completed,* consist of four or five bays, each bay containing 15 retorts. *At present only one bay is in actual work* . . . and the completion of the remaining bays is now actively in progress." During my experiments, the maximum coal gas make in the section of the works in question was 1,320,000 cubic feet per day. Does it require excessive reasoning power to realize that plenty of oxygen was available for purifying purposes?

L. T. THORNE.

69, *Horseferry Road, S.W., Dec.* 8, 1893.

[This is as we supposed. The extra quantity of oxygen spoken of by Dr. Thorne and Mr. Herring as admitted at the exhauster for purification purposes, was only available because the oil-gas plant was not running at its full capacity. When it does, all the oxygen producible on the works will be wanted to make up the full 200,000 cubic feet of oxy-oil gas per day. Then, where will the extra 0·8 per cent. of oxygen needed for the purifiers come from?—ED. J. G. L.]

SIR,—Dr. Thorne, in his letter in your issue of the 5th inst., again refers to results reported as obtained here from the Peebles oil-gas process, giving the illuminating value of the gas at 63 candles, as against 100 candles in Mr. Linton's report; whereas the facts are simply these: Last year I was supplying 23-candle gas made from splint coal, cannel coal, and shale. This year, during the whole month of October, I used nothing but splint coal and oil. The splint coal yields 17½-candle gas. By adding 12½ per cent. of oil gas, I raised the illuminating power to 28 candles (equivalent to 10½ candles enrichment) for 12½ per cent. of oil gas, or 0·84 candles per cent. of oil gas; the cost of enrichment being 0·25d. per candle per 1000 cubic feet.

The fact that Dr. Thorne should quote such figures, so widely different from what his experience must have shown him to result from the cracking up of oil at low temperatures such as obtain in the Peebles process, seems to me to indicate a certain amount of bias which must seriously detract from the value of Dr. Thorne's own figures relative to the wonderful effect resulting from the presence of oxygen.

W. THOMSON.

Musselburgh, Dec. 9, 1893.

SIR,—I have read with very great interest the paper and discussion upon the above subject at the meeting of the Southern District Association on the 23rd ult. It must be a source of much satisfaction to all concerned with the process to have called forth such a good debate, which, as the President remarked, was certainly the best compliment anyone could pay to the author. As one interested in the subject of oil gas, and being unable to attend the meeting, I should like to make a few observations.

I looked in vain for what I consider, with Mr. Valon, to be most important information, which, had it been supplied, would have considerably advanced our knowledge of the special part, if any, played by oxygen—viz., an analysis of the oil gas alone, of the oxy-oil gas after passing the purifiers, of this gas after passing the foul main, of coal gas and oxy-oil gas, of coal gas alone, of the same coal gas and equal quantities of oil gas and oxy-oil gas, together with the illuminating power of the gas in each case. A rather formidable request, you may say. Quite so; but, at the same time, is it not a most important part to omit? Certainly it is not at all difficult to ascertain; but perhaps we shall receive this information when the work has been further advanced. Returning to the paper, I think everyone will agree that, by no stretch of the imagination, can one look upon the action of oxygen as a chemical one; and it certainly becomes difficult to imagine, even allowing oxygen to have a solvent action upon the heavy hydrocarbons, how this small quantity can produce such improved results. Taking it for granted that oxygen does exert, shall we say, a partly solvent and a partly carrying action, have we not here a means by which we can easily settle this point. Suppose we remove this oxygen by any of the usual methods, then, its solvent and carrying power being removed, we should have condensation of those hydrocarbons upon which the oxygen had operated, and by taking the loss in volume, deducting the known volume of oxygen, the difference would show the amount and value of the oxygen as a solvent. Or, better still, first make an analysis of the oxy-oil gas, or coal gas and oxy-oil gas, and then, with another sample, remove the added oxygen, leave for some time under conditions of temperature and pressure met with on the works, and then make an analysis of the remaining gas (from which the oxygen has been removed). The difference would give the value of the oxygen. In the last case we should expect to lose some of the heavy hydrocarbons. If this was found to be so, then we should clear the ground for further investigation. Again, granting that oxygen does act as a solvent, and carries forward condensable hydrocarbons, would it not be more economical to break the hydrocarbons a little more, and make them self carrying?

I am inclined, to think, from experiments I have made, that some difference will be found when the oils are cracked up further, as proposed—a difference that will point to oxygen not being so valuable under these new conditions. This point is specially worked out in my new oil-gas process; the object being to produce less coke, without liquid residuals, with, of course, a larger yield of gas, all in one operation, without condensing and cracking up again. Should this further cracking of the oils still show the same value on adding oxygen, then we must admit that oxygen gas plays a part special and peculiar to itself. So far as my experiments go, I am inclined to the belief that a considerable quantity of condensable hydrocarbon residues must have been made at Huddersfield. Mr. Herring's remarks as to the choking of the apparatus points strongly to this, as well as the fact that only 5 per cent. of coke has been obtained. We have the Peebles process, with its 25 per cent. of coke; and the process under discussion, with only 5 per cent.—a difference of 20 per cent. in favour of the oxy-oil process, which ought to show a large and substantial increase in the make of gas per ton of oil over the Peebles process. If it does not, then we have a loss of 20 per cent. of valuable coke, which, taken in conjunction with some hydrogen, form residual and fluid hydrocarbons, useful for furnace work only, besides being a constant source of trouble and annoyance.

The remarkable experience given by Mr. Helps, and also noticed by Dr. Thorne, might be cleared up from an analysis of the gases. The difference in composition would indicate the direction in which the oxy-oil gas acts. But is this difference always found, and always in the same proportion—say, under the varying conditions of temperature and pressure met with every day, or even under the same conditions of temperature and pressure? The paper no doubt points conclusively to some action of oxygen; and, for an explanation, we must undoubtedly look to the condensable hydrocarbons, and not among those hydrocarbons which are gaseous at ordinary temperatures. From experiments not yet completed, I have found that oxygen, in common with other gases, will carry condensable hydrocarbons; and that, if this oxygen should be removed, these hydrocarbons rapidly condense. I am not in a position to state at this stage the amount and kind of hydrocarbon it can best carry forward. I find it varies very much with the nature—the weight and density—of the hydrocarbons; making it totally different from its value as an illuminant. Hydrogen gas possesses the same property, but to a smaller extent. In some cases, this difference would appear to be in direct relation to the various densities of these gases. This would explain why marsh gas is a better carrier than hydrogen; but it does not show us why carbonic oxide is not so good a carrier as marsh gas. We can scarcely explain this as being due to "family likeness;" marsh gas having a nearer relation to these heavy hydrocarbons than carbonic oxide. However, putting this on one side, we have two things to consider in the selection of a carrier—first, its value simply as a carrier; secondly, its effects upon the illuminating power of the resulting product. One would almost imagine that, if these gases acted simply as carriers, the greater the density of the carrier (granting, of course, that we have a permanent gas), the smaller would be the volume required to carry the same bulk of condensable hydrocarbons, compared with a lighter carrier. But is this truly the case? I trow not.

R. S. MOSS.

Dec. 4, 1893.

An "Improved" Invariable-Water-Line Gas-Meter.

SIR,—Some years ago you published a description of the "Syphon Overflow" which I had invented. In the last number of the JOURNAL (p. 1039), you published a description of what appears to me to be a very imperfect attempt in the same direction.

As the "Syphon Overflow" was patented and published in France, total ignorance of that invention on the part of your correspondents is scarcely conceivable. And yet it is only fair to suppose that MM. Maldant, Dupoy, et Cie., had never heard of my "Syphon Overflow" (and of the *complete* and *final* character of that invention) when they designed their meter.

I would suggest to the inventors above referred to that they should read the specification and the published descriptions of the "Syphon Overflow" before they take any further steps in connection with their invention. They will thus, possibly, increase their knowledge of the conditions of the problems I had to solve, and which the "Syphon Overflow" *effectually* settled.

WILLIAM COWAN.

Edinburgh, Dec. 8, 1893.

The Meeting of The American Gaslight Association.

SIR,—There are two points in connection with the proceedings of the American Gaslight Association, as recently reported in the JOURNAL, upon which I should like to offer a few remarks.

The first occurs in the paper on "The Rate of Purification," by Mr. J. A. P. Crisfield, in which the author deals with the volume of oxide and the quantity of gas passed per hour, and from those two elements deduces the contact-time. He also states that the fewer the number of boxes, the better the results. This is a very indirect way of getting at the fact that not only must there be a minimum contact-time, but also a minimum contact-velocity. Assuming that the depth of the vessels remains at a fixed measurement, it follows that the fewer the number of vessels, the larger the area, and therefore the slower the contact-velocity. On this point, Mr. Newbigging says (see "Handbook," p. 107): "The capacity or purifying power of the vessel is determined more by its superficial area than by its cubical volume;" and the capacity of the vessel is obviously the same as, or directly proportioned to, the volume of oxide spoken of by Mr. Crisfield. That the introduction of air or oxygen has so far reduced the cost of labour as to render the item of interest on capital invested in purifying apparatus by far the most important in the cost of purification, is quite correct; but at the same time it is necessary to recollect that such cannot be efficiently applied without a proper area of material, or, in other words, without certain limitations as to contact-velocity. So that, in theory, the thinner the allotted volume of oxide can be spread, the better will be the result. Contact-time is proportionate to the volume of oxide; contact-velocity, on the other hand, is a function of the superficial area of the purifier.

But while theory indicates that the most economical method of purifying is to have the material in one mass, or, to use Mr. Crisfield's expression, to reduce the number of purifying vessels as low as possible, the practical consideration of how far it is safe to trust all one's eggs in one basket comes in. No gas engineer would go to bed happy, at any rate at this time of the year, knowing that the purity of his gas supply was dependent upon the satisfactory behaviour of one mass of oxide, or even of two. Small summer makes may be left to a single

layer; but when fluctuations of make and of temperature have to be contended with, one likes to have a good reserve. However large the area, many would prefer to have at least three beds in use. This leads up to another consideration, and that is the minimum thickness of a bed of purifying material that may be regarded as safe in practice.

Mr. Crisfield also overlooks the point that, apart from cheapness and efficiency, the question of nuisance and of loss of gas in changing purifiers comes in. Large purifiers have become the rule, especially in gas-works situated in crowded localities, not merely because they are economical, or from a belief that they save money; but as a means of minimizing nuisance by reducing the number of changes. Even if they brought no economy with them, many would prefer to incur the extra expenditure represented by the additional interest on capital, for this reason.

The second point comes in the paper on "Mathematical Analysis of Photometrical Observations," by Mr. F. B. Wheeler, which contains an ingenious suggestion for the investigation of conflicting experiments. But it appears to me to be applicable only to the results of observations upon one sample of gas which was known to remaim constant throughout the series. In the example cited of the results of tests taken on twelve consecutive days, it appears that not only were twelve different samples operated upon by the engineer, and that all these samples may possibly have varied in quality, but there is nothing to show that the gas examiner had anything in the way of similar samples. The gas might have varied from hour to hour; and if the engineer operated at one time of day and the examiner at another, the results would necessarily vary. Probably such was the case in the present instance, because on one occasion the examiner records a result nearly 2½, and on another 1½ candles higher than the engineer; while on a third he is 1½ candles lower. These three items contribute four-fifths of the sum of V^2; and it seems more reasonable to suppose that they are due to fluctuations in the quality of the article tested rather than to experimental errors. If the testing-station was some distance from the works, it is only in accordance with the usual experience to suppose that the results arrived at by the examiner would exhibit a greater degree of variation than those obtained at the works.

Salisbury, Dec. 5, 1893. NORTON H. HUMPHRYS.

The Gas Institute Index.

SIR,—"When anger enters the heart, reason flies out of the head." The Chairman of the Publications Committee of The Gas Institute (Mr. Norton H. Humphrys, of Salisbury) must have been very irate indeed when he penned the letter which appeared in the last issue of the JOURNAL, referring to my criticisms on the subject-matter index of The Gas Institute "Transactions" for 1893 (*ante*, p. 935). It is, therefore, extremely difficult to frame an adequate reply, without introducing that personal element from which all technical communications or discussions should be free, and which is certainly not conspicuous by its absence in his letter. There are, however, one or two points in the letter which cannot be allowed to pass unnoticed. This done, the matter is ended so far as I am concerned. There is the index, there are the criticisms; those interested must judge for themselves.

Mr. Humphrys appears to object that the article was written by a non-member of the Institute. If he refers to the lists of members, he will find that I had the honour of enrolling my name there prior to the ever-regrettable split of 1889, when I resigned in common with many others. So that in a measure I have a right to criticize the work of the Institute. But the question of membership does not enter into the matter at all. The "Transactions" are public property, *so far as the gas world is concerned*. If the Institute as a body is satisfied with its index, well and good—*chacun à son goût;* but the members surely will not object if the tastes of others differ from theirs.

That the general tenor of the article was approved of is manifest from the letters of Messrs. Sheard (*ante*, p. 936) and Brackenbury (*ante*, p. 1040), and still more so from a letter addressed to me by the Chairman of the Committee himself, in which he asked to be furnished with a complete list of the errors, &c., in the index in question, "as it will," he says, "be of great assistance to me in preparing corrections for next edition." So, evidently, Mr. Humphrys has no objection to accept help from outside, though, as head of the Committee, he appears to have a most emphatic objection to outside criticism. This list shall be sent with pleasure, shortly; though it is doubtful if it will be received with equal pleasure. Because, when the article was written, that wonderful "forty-horse power microscope" (*vide* Mr. Humphrys) had only been applied to about half the volumes of "Transactions;" and the list may, therefore, be longer than is expected.

Mr. Humphrys insinuates that my copy of the "Transactions" was procured through the kindness of a friend, or by courtesy of the Council. It was procured through a channel that is open to any member of the profession, whether belonging to this or that society—viz., through an ordinary book dealer. The Council offer copies to whomsoever is interested enough to purchase them. Courtesy has nothing to do with the matter. It is purely a question of "£ *s. d.*," as no one knows better than Mr. Humphrys himself. If he refers to the JOURNAL, Vol. LVI., p. 712, he will find an advertisement headed "Rare Opportunity"—it is about half-way down the centre column; and in it certain books are announced as for sale, among them several volumes of "Transactions," offered at 3s. each. That advertisement was put in by Mr. Humphrys himself; and the result of a slight correspondence was, that he "courteously" allowed me to become possessed of three or four volumes, in consideration of certain coins of the realm passing from my pocket to his.

I maintain that my criticisms are perfectly fair. Of course, I do not know what instructions the Council gave the Publications Committee. Would Mr. Humphrys have me infer that he and the other members of the Committee were instructed to prepare an index that should not be over-accurate?

The article was not written without knowledge of the subject. My first index was compiled more than twelve years ago; and very heavy work it proved. It was because I *did* know something of what I was writing about that I committed the article in question to paper. Perhaps herein lay my mistake.

It is with great regret that I write so strongly, and should not do so had Mr. Humphrys followed his first intention, and left the article to bear whatever condemnation it merited in the opinion of its various readers. His action will not benefit either himself or his friends. It will certainly draw more attention than ever to the need of a good index, and will, in that way, perhaps, prove beneficial to the gas world at large.

The purely personal parts of Mr. Humphrys' letter must, of course, be passed over in silence.

Liverpool, Dec. 8, 1893. ALEX. M'I. CLELAND.

Indicator Diagrams on a "Time Base" for Steam and Gas Engines, &c.

SIR,—In taking indicator diagrams, it is customary to give the paper a reciprocating motion corresponding to that of the piston of the engine. Thus the length of such a diagram is proportional to the length of the piston stroke, and any fraction of the one is proportional to the same fraction of the other. This is the ordinary Watt diagram on a base-line of feet of piston, in which the paper is travelling at its maximum speed in the middle of the stroke, at the two ends gradually diminishing, then stopping and reversing with the piston.

For many practical purposes, such diagrams are very convenient, and quite sufficient; but for other scientific investigations, they are not altogether satisfactory. For the more advanced steam engineer or student, who is busied with the hidden mysteries of cylinder condensation, they are unsatisfactory, because the slow motion of the paper near the ends of the stroke makes measurements at such parts impossible. Yet it is just at these points that accuracy is required; for it is immediately on the admission of steam that condensation is most active, and the area of the already cooled metallic surfaces acting on the steam varies least. Here the steam is at its maximum, and the walls at their minimum temperature.

To obtain a clearer delineation on paper of the changes in pressure occurring near the two ends of the stroke, it is necessary that the motion of the diagram-paper should be much more rapid than is possible when it is connected to the piston-rod. This increased speed can sometimes be obtained, in the case of compound engines, by driving the drum of the high-pressure indicator by the crosshead of the larger cylinder coupled at right angles to the first. The complication involved, however, in connecting any particular part of the diagram with the corresponding part of the piston stroke, and marking on it the corresponding time—so important a factor in investigations on the transmission of heat from the steam to the walls—seems to point to the use of paper moving uniformly as more suitable. It is to call the attention of professors at scientific colleges, and those who are studying this question, and who may have the will and the opportunities for making experiments, to this method, that it is described; and it should be more generally known and used, whether it is novel or otherwise.

For want of a better term, such diagrams may be called "time-base" diagrams, in contradistinction to the ordinary "Watt figures," the base of which represents the feet passed through by the piston. The study of "time-base" diagrams has often been recommended by Mr. M. Longridge, and others interested in the practical working of steam-engines; and there can be little doubt that they yield additional information, which the ordinary closed figures cannot furnish. The necessary apparatus, though perhaps a little more complicated than the ordinary indicator, is not difficult to apply to any engine. A band of paper (non-metallic preferred) 2 or 2½ inches wide, driven by clock-work at a constant speed, with provision for starting and stopping, is all that is required.

As the subject may interest your readers, I enclose two diagrams taken by two indicators during the same stroke from the bottom of the high-pressure jacketed cylinder of a compound engine; both indicators being of the same type and from the same maker, and having springs of the same scale.

[Referring to the diagrams, our correspondent says: The first figure is an ordinary diagram with a base-line of feet of piston, on which each tenth of the length is proportional, not to equal times, but to each tenth of the piston stroke. Here it is not seen at once where compression ends and admission begins, nor the increase of the pressures in the cylinder in ratio of time. The admission of steam before the dead point is also not shown. The second figure is a continuous time-base diagram on which each twentieth of the base-line corresponds to a twentieth of the time of one revolution of the engine. This diagram, like the first, can be also used for calculating the work done in the cylinder, or obtaining the mean pounds pressure; but care must be taken to divide the base-line unequally, and in proportion to the feet of piston. The letters show these divisions. The two methods give identical results if properly worked out. The inclination of the steam-admission line on the "time-base" diagram is closely connected with the amount of initial condensation; the hotter the metal and the drier the steam, the more nearly will it approach the vertical with the same area of ports and the same revolutions of engine. With steam-jackets and superheated steam, the writer has found the angle between the two to be a minimum. In comparing this angle, the speed of paper must be kept the same. The throttling of the steam through the valves and ports (of different areas and lengths) will also affect this angle, as also the time per revolution.]

Any indicator can be used with the moving paper, and the atmospheric line added without difficulty. With the ordinary indicator, a fresh paper has to be put on for each diagram. In the case of a continuous band, it lasts a considerable time without renewal. M. Guinotte several years ago designed a somewhat similar arrangement; but he drove his band of paper from the engine. Professor Dwelshauvers-Déry had also used this latter method in connection with rolling-mill engines; taking a series of continuous diagrams to show the gradual and quick variations of power. Exact results could not be obtained in such a case with an ordinary indicator and single sheet diagrams. It would be instructive to take continuous diagrams on starting a non-jacketed engine until the walls acquired their normal temperature.

Professor Cotterill happened to be present when the two diagrams were obtained; but many others have since been taken from 2 to 12 inches long.

Bermondsey, Nov. 24, 1893. BRYAN DONKIN, JUN.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Tuesday, Nov. 28.

(*Before Mr. Justice* MATHEW *and a Special Jury.*)

Green and Haydon v. The Chelsea Water-Works Company.

This case raised an important question as to the liability of the defendants for injury caused to the plaintiffs' property by reason of the bursting of one of the Company's mains in the Putney Hill Road. The plaintiffs are livery-stable and cab proprietors, carrying on business at 141, Upper Richmond Road, Putney. The defendants are the owners of a main which carries water from their reservoir on Putney Heath to Fulham. On Jan. 10, 1889, this main burst; and the water rushed in great volume into the Railway Tavern, and thence into the plaintiffs' stable at the rear; bringing down one of the walls of the tavern and the stable on to the railway lines, and doing great damage to the tavern, the plaintiffs' premises, and the Railway Company's property. The plaintiffs alleged that they had suffered great loss and injury to their horses, carriages, and stock from the negligence or default of the defendants in not properly or skilfully constructing and laying down the main in question, or in not keeping it in good repair, so that it burst. The defence was that the main was duly laid by the defendants in pursuance of their statutory powers, and not otherwise; and they contended that the statement of claim did not allege any cause of action, on the ground that, being under a statutory obligation to supply water, they were not liable for the damage occasioned by its escape, unless such damage was caused by their negligence, or the negligence of those for whom they were responsible. They denied that they were guilty of any negligence or default; and they asserted that the main was properly and skilfully laid, and was kept in proper repair. They further said that, if the bursting of the main was due to any defect therein, this was one which could not have been discovered by the exercise of reasonable care and skill.

Mr. KISCH and Mr. LACEY SMITH appeared for the plaintiffs; Sir R. E. WEBSTER, Q.C., M.P., Mr. F. MOULTON, Q.C., and Mr. ENGLISH HARRISON represented the defendants.

Mr. KISCH having opened the case, and narrated the facts above stated, the proceedings were adjourned.

Wednesday, Nov. 29.

At the sitting of the Court this morning,

Mr. KISCH stated that it had been arranged between himself and his learned friends on the other side that, assuming the defendants to be held liable, the damages should be assessed at £120.

Mr. *Haydon*, one of the plaintiffs, said the main in question burst soon after one o'clock in the afternoon; and the water continued running with unabated force for about 3½ hours. He had seen the piece of pipe where the breakage took place; he had put in his hand, and had taken out a great quantity of slime and rust.

Frederick Richard Morris, a cab driver in the employment of the plaintiffs, gave evidence as to the bursting of the pipe at about half-past one on Jan. 10, 1893. He said the water ran down Putney High Street like a river for about two hours. He saw the fragment of pipe where the accident occurred, and was of opinion that it was eaten away by rust.

Cross-examined: The burst occurred about 100 yards from the railway, towards Wimbledon Common. He drove first to the Southwark and Vauxhall Water Company's turncock, who said the main did not belong to his Company. He then went with a constable to the reservoir on the Common, where he saw Mr. Brown, the turncock in charge. He went to the reservoir twice with the constable; and ultimately a messenger was despatched to Surbiton. He waited some time with his cab outside the reservoir, but did not see what Brown was doing while he was waiting.

Charles Clayton, a police-sergeant, was next called. He said he went with the last witness to the reservoir, and saw Brown. They were there about half an hour, during which time Brown was trying the cocks to turn the water off; but they were so stiff that he could not move them. He then went with Brown to look at the fractured pipe, and again returned to the reservoir and assisted him; and then they managed to turn one of the valves five times. He could not tell, when he was at the reservoir, whether or not the water was turned off.

James England, another police constable, deposed to having witnessed the accident. The water reached the plaintiffs' premises about an hour after the burst occurred. It came with such force and in such volume that it pushed down the wall of the Railway Tavern, and rushed on to the line, where it caused considerable damage; delaying the traffic for some time.

Mr. *R. W. Goodman*, station-master at East Putney, stated that, at the time of the accident, he was booking-clerk at Old Putney Station. The burst occurred just as he was going to his dinner. The water reached the plaintiffs' premises from the back. He produced photographs he had taken on the spot. He had heard that the Railway Tavern was damaged to the extent of about £3000.

Mr. *G. W. Usill*, Assoc. M.Inst.C.E., was next called. He said the soil in which the water-pipes were embedded at the scene of the accident was very peculiar, consisting of gravel with a certain quantity of clay intermixed. This sort of pipe was now always dipped in Dr. Angus Smith's solution; and the interior was lime-whited. This was done to prevent corrosion. This solution was first brought into use about 25 years ago; and, in his experience, it had the very greatest effect in preventing corrosion in water-pipes. He should consider that the corrosion was greater in the early life of this pipe, by reason of the fact that the Thames water was then not so free as it was now from sewage matter and other things that affected water-pipes. After the mains were laid and jointed, and before the trench was filled in, at least 50 per cent. more than the working pressure should be put on in order to see if the joints were perfect, and if there was any "sweating" of the pipe, which would show weakness. Before the accident, there were no sluice-valves in the main nearer than the reservoir. Two valves had been put in since the accident; but there ought to be more than there were even now. In an ordinary case, where the main-pipes were supplying the district, and service-pipes were branching off right and left, there should be a sluice-valve at the end of every street; but the main where the accident occurred did not supply any district nearer than Fulham. It was a conduit passing through foreign territory; and greater precautions ought to be taken for shutting off the water than there were. In his opinion, the main in question should have been tested at least three times in the 33 years of its existence. The testing would probably take about a day and a half, and was not at all a difficult matter. He thought the reason the sluice-cocks could not be properly turned off was because they had not been used for a considerable time, and had become rusty.

Cross-examined: He was first consulted in the matter about a month ago. He had not taken charge of any water-works in the Metropolis. In his opinion, the pipe used was not of sufficient thickness. The pipe produced to him was only 13-16ths of an inch thick; but he considered it should be at least an inch in thickness.

Re-examined: If stones were found embedded in the outer shell of the pipe, it would be evidence of corrosion within.

Mr. R. *Bell*, a road surveyor in the service of the Wandsworth Board of Works, said the Southwark and Vauxhall Water Company were in the habit of testing their trunk mains which ran through the parish of Wandsworth. Two years ago, serious damage was done in Wandsworth by bursting mains; and it was since then that the tests had been made. The testing was carried out by means of air-valves. He had seen many lengths of water-pipes exposed in the Wandsworth and Putney district; and they had generally a scaly corrosion on them. He produced a 2-feet length of pipe which had been taken out of the road at West Hill, Wandsworth, about a mile from the scene of the accident. This piece of pipe he considered showed signs of corrosion both internally and externally.

Cross-examined: He did not know that the air-valves were put in by the Southwark and Vauxhall Company in Wandsworth in consequence of a number of breaks arising from the employment by the Company of a new pumping-engine.

This closed the plaintiffs' case.

Sir R. E. WEBSTER then briefly addressed the jury, and stated the nature of the evidence he intended to call on behalf of the defendants.

The evidence of Mr. *W. B. Bryan*, M.Inst.C.E., the Engineer to the East London Water-Works Company which had been taken on commission, was then read. It stated that, from his experience as an engineer, the specification was ample for the carrying out of work of a most excellent character. The main in question was properly made and laid down. He could not suggest any construction or precaution that would diminish the liability of the water-mains to burst. In his opinion, it was absolutely impossible to devise any means to ascertain when a pipe was likely to burst. He had known mains to give way which were thicker than the fractured one. A case was within his knowledge where a main burst which was 1¼ inches thick. It had been down seven years, and burst unaccountably. So far as his investigations went, all reasonable and proper precautions were taken to avert danger. Dr. Angus Smith's solution was a precaution now adopted to prevent corrosion. He could not give any other reason for the main in question bursting than changes in the temperature of the water. Thames water did not cause deterioration in pipes; on the contrary, it formed in them a protective coating of carbonate of lime. He was quite clear that what air-holes he saw in the pipe were not in any way the cause of its bursting. There were no means of detecting air-holes while the pipe was still entire.

Mr. *H. Brown*, formerly in the service of the defendants, deposed that he had been for thirty years in charge of the reservoir on Putney Heath. He remembered the day of the accident. It was about ten minutes to two when he was called by the police-constable. He fixed the time by the fact that he had to turn off the water at the stand-pipe at two o'clock. He asked the policeman whereabouts in the road the burst had occurred; and he concluded by the answer he received that it was in the Chelsea main. He sent his man Wheeler to turn off two of the cocks, in doing which there was not the least difficulty. The valves were turned off and on every day. The fact of having a stand-pipe necessitated the valves being turned off constantly. It was quite untrue that he had any trouble in turning off the valve, or that he had to get assistance. He had to turn three valves; and Wheeler had to turn two. This took about 25 minutes. After doing this, he went down to where the burst had taken place. At this time the pipe was emptying itself, and the pressure was off. He then closed another valve below the fracture, in order to prevent the water from coming back. A telegram was sent to Mr. Hack, the Engineer, at Surbiton. He had no suspicion of anything being wrong with the main until the burst occurred.

Cross-examined: When he arrived at the scene of the accident, after he had shut off the valves at the reservoir, the water was not running half so fast as he should imagine it was when the burst happened.

Harry Wheeler deposed that, at the time of the accident, he was assistant to the previous witness in the service of the defendants. He received instructions from Brown to shut off the two 30-inch cocks on Wimbledon Common. This took him about ten minutes. He then assisted Brown to shut off the cocks on the top of the reservoir. All the valves on that day were in good working order.

Sir *F. J. Bramwell* was then called. He said he had resided in the neighbourhood of Putney for some fifteen years, but had no personal knowledge of the accident. In his opinion, the main would, under ordinary circumstances, take half an hour to empty; but it would require a longer time if the valve at one end were shut, because no air could get in at the end where the closed valve was to release the water. Mr. Simpson, the Engineer who designed the laying of the pipes 33 years ago, was one of the highest in his profession in his day; as also were Messrs. Cochrane, the contractors who carried out the work. The specification under which the pipes were laid was amply sufficient to ensure good work. The alteration that would be made in it at the present day was that Dr. Angus Smith's solution would be specified. This composition was not known when the pipe in question was laid.

Thursday, Nov. 30.

Sir *F. J. Bramwell*, in answer to further questions, said he had never heard of any system of periodic testing of water-pipes after they had been once laid. It was his experience that these breaks did occur from time to time, from unaccountable causes, not only in water-mains, but in other instances where cast iron and even steel were employed for pipes. Nothing could be done to find out that a particular pipe, in lengths of miles, was deteriorating, except where there had been breaks in the neighbourhood. The piece of pipe produced by the witness Bell did not show any indications of corrosion, or anything that would weaken the material of the pipe.

Cross-examined by Mr. KISCH: He had never been consulted professionally in regard to the actual construction of water-works; nor had he seen the particular pipe in question actually in the trench. Practically, these pipes, under ordinary circumstances, did not corrode. He could not give any limit of time for the life of such a pipe. His reason for saying this was that cast iron, from the nature of its manufacture, was a material which would wear for an unlimited time. Dr. Angus Smith's solution was an extra precaution which he would adopt in the same way that he would double-lock a door when one lock would do. There might be a testing of the pipes; but it would involve a great deal of expense, and constant stoppages of the water supply. It would be an idle proceeding to have periodical tests, because the mains were, as a fact, always subjected to a working test by being in daily use. Testing by a steam-pump could not be carried out in the present case; and, in any circumstances, he should consider it most risky and improper. There would be about 75,000 gallons of water in the three-quarters of a mile between the reservoir and where the burst took place. No doubt the more sluice-valves there were in a trunk main, the more precaution there would be against accidents. He could not assign any cause for the bursting of the main. In most cases it was matter for conjecture. He did not consider that the now more frequent use of road-rollers was an additional reason for applying periodical tests. In the fragments of the pipe produced by Mr. Bell, there was no evidence of such corrosion as would affect the strength of the pipe. Of course, there was a certain amount of rust.

Re-examined: He did not know any water that was better qualified to protect water-pipes than that of the Thames.

Mr. *Albert A. Gill*, Assoc.M.Inst.C.E., the District Engineer of the defendant Company, said he was at the scene of the accident a little after three o'clock on the 10th of January, 1889. There was a fair flow of water welling out of the hole in the pipe; but he could tell at once that the valve had been shut off, and it was only "dead" water that was coming out. He remained till about seven o'clock, when he left his assistant in charge. He did not notice any pipe visible up to the time of his leaving. He returned again about nine o'clock, when Messrs. Lucas and Aird's men had just got down to the pipe. It had a longitudinal fracture from 4 to 5 feet long on the under side. He saw no signs of corrosion in the pipe when it was taken out. There was some rust; but the account given by the plaintiffs' witnesses was greatly exaggerated.

Cross-examined: The water ceased entirely to run from the hole between four and five o'clock. He did not know when it was shut off at the reservoir. There had been no valves put on the main since the accident. The Company had no machine in their possession for testing by hydraulic pressure. When a new main was laid, it was usual to test it by this means.

Mr. *H. J. Gooch*, assistant to the last witness, stated that he arrived at the scene of the accident about a quarter-past three, by which time the water had been turned off. He remained until about six o'clock.

Cross-examined: It was about three-quarters of a mile from the burst to the reservoir. In 1886, four valves were placed about 100 yards below the burst; but there were none on the reservoir side.

Mr. *R. Hack*, Assoc.M.Inst.C.E., the Company's Engineer, said he reached the scene of the accident about four o'clock. Nothing could have been done at Surbiton in the way of shutting off the water, except stopping the engines. There was no piece of pipe on the surface of the road until it was taken out by the workmen. The fracture was on the lower part of the pipe. When he saw the pipe after it was taken up, it did not show any signs of deterioration. It was not true to say that handfuls of rust could be taken out of the pipe. He had never known of any testing of water-mains after they had been laid.

Cross-examined: Air-valves were employed for the purpose of charging a main. He considered that the soil in which the pipe was laid answered the requirements of the specification. He did not admit that clay was destructive to the pipes. In his opinion, it made no difference whether they were laid in clay or in gravel.

Mr. *J. W. Restler*, M.Inst.C.E., who had been for some twenty years in the service of the Southwark and Vauxhall Water Company, said he had seen the piece of pipe produced by Mr. Bell, which had been in the ground from twenty to forty years. The mains of his Company were not tested after the trench had once been filled in; and he did not believe it was possible to do so. There were a large number of valves in Wandsworth High Street; but they were fixed solely for the purpose of making connections with other districts. In his opinion, no engineer could have anticipated the likelihood of the burst; nor could he have taken precautions to prevent it.

Cross-examined: Even if there was a valve 50 yards from the burst, it would have been quicker to go to the reservoir to turn off the water, because they would have had to go there to get the tools; and the hole where the valve was would have to be cleaned out. He considered the cause of these breaks was the contraction of a long length of pipe expending itself on one particular length.

Re-examined: In his opinion, not one fracture in a hundred was caused by the pressure of the water.

Mr. *E. Easton*, M.Inst.C.E., said he had had very large experience in laying water-mains. He did not know of any practical means of testing mains when they had once been laid and covered in. The bursting of water-mains was generally brought about by causes other than the pressure of water. It was possible that changes of temperature had a great deal to do with it.

Cross-examined: After a main was laid, he should test it to 50 per cent. more than its working pressure.

Sir R. E. WEBSTER then proceeded to sum up the defendants' evidence. He said if this had not convinced the jury that there was no negligence on the part of the Company, no speech of his could do so. With reference to the suggestion that there ought to be more sluice-valves, the answer was that no reasonable man would put them. As to whether or not the water was turned off at the reservoir as quickly as it possibly could be, he relied upon the evidence given by the witness Brown, who deposed that the valves were closed within three-quarters of an hour after the burst. He concluded by contending that the defendants had in no way been guilty of the negligence attributed to them.

Mr. KISCH then replied on behalf of the plaintiffs. He said that he should divide the negligence he alleged against the defendants under two heads—first, that they did not make periodical tests of their mains, whereby any defect in them would have been discovered; and, secondly, that the Company's servants had not turned off the water at the reservoir within a reasonable time after the bursting of the main. He then proceeded to comment on the fact that the Company had not called any independent witnesses to depose as to the time or duration of the burst.

His LORDSHIP then proceeded to sum up, and concluded by leaving the following question to the jury: "Was the damage to the plaintiffs' property caused by any negligence of the defendants in the management of their main? If yes, what precautions do you think ought to have been adopted to avert the accident?"

The jury, without retiring, returned a verdict for the defendants.

His LORDSHIP, on the application of Mr. KISCH, postponed pronouncing final judgment until the plaintiffs had had an opportunity of considering whether they would argue the matter on a point of law.

Friday, Dec. 8.

Jenkins v. Hastings and St. Leonards Gas Company.

This was an action to recover damages which the plaintiff had sustained by the destruction of his works at Hastings by a fire caused through the alleged negligence of the defendants' servants. The defendants denied that the fire was caused by their servants, or that they had been negligent. In the event of the defendants being held to be liable, it was arranged that the damages should be assessed by an arbitrator.

Sir H. JAMES, Q.C., M.P., and Mr. WOOD HILL appeared for the plaintiff; Sir E. CLARKE, Q.C., M.P., Mr. JELF, Q.C., and Mr. NORTH represented the defendants.

Sir H. JAMES, in opening the case, said, although he was afraid the attention of the jury would be occupied for some little while in determining the issue raised between the parties, he thought he should be able in a very short space of time to place before them the real issue which had to be tried. The plaintiff was the owner of the Grosvenor Works at St. Leonards, which works were burnt down on the 14th of January last. The plaintiff's view was that the destruction of the premises was occasioned by the negligence of the defendants' workmen. It appeared that upon the works there was a gas-meter, and the pipe leading to it occasionally became foul owing to the collection of naphthalene; and it was to the interest of the Gas Company as well as to that of the consumer, that this should be removed, as in one case the quantity of gas burnt would be smaller if the obstruction were not taken away, and in the next the light would be deficient in quantity. The Company issued notices to the effect that, in the event of naphthalene accumulating, notice should be forwarded to the gas-works, in order that men might be sent to remove the obstruction. In pursuance of this request, notice was given to the Company on the 5th and 13th of January that fouling existed; and, accordingly, on the 14th of that month, two men called to clear the pipe. The men disconnected the pipe; and having blown it out they restored the connection, and asked some workmen engaged on the premises, for matches, in order to see whether or not the joint had been made good. It being near one o'clock on a Saturday afternoon, the men were anxious to leave; and they told the Gas Company's men that the time had arrived for closing the works. Shortly after one o'clock, both the plaintiff's and the defendants' men left. At this time there was no evidence of any fire. The defendants suggested that the fire broke out in the paint-shop overhead; but he should call evidence to prove that no fire had been in this shop after ten o'clock in the morning. Shortly after two o'clock, a person in the road near the works observed that smoke was issuing from the eastern part; and, upon access being obtained, it was found that the fire was immediately above the gas-meter, in the wooden flooring. Upon an examination being made, it appeared that the leaden outlet-pipe had become melted, and there was a jet of flame springing up straight from the meter to the flooring above. A man turned off the cock in the supply-pipe; but, unfortunately, the fire spread all over the works, and ultimately they were destroyed. Then arose the question, How did the fire occur? The defendants said it was true the jet of gas came from the meter after the pipe had become melted; but the fire was not, they said, caused by their workmen in applying a lighted match some time before, but originated in the paint-room above. If so, it was a most remarkable thing, because that shop was some distance from the hole which had been burnt through the floor. He was not able to say what the defendants' men did; but it was humanly possible that, if they did not carefully close the joint, there was an escape of gas, which ignited when they applied the lucifer, and that this was not seen owing to the sun shining into the room. After they had left, however, the flame by degrees loosened the solder, and in turn the leaden pipe was gradually melted away. The gas men might say that there was no jet of gas; and, of course, if they had seen it they would have put it out. But the contention on behalf of the plaintiff was that these men had not been sufficiently careful in seeing whether or not the light was there.

Saturday, Dec. 9.

William Stammers, the plaintiff's foreman, who was the first witness called, deposed that the gas-meter was about 7 feet from the ground.

It was about 21 feet from the meter to the eastern end where the fire was discovered; and 2 ft. 6 in. from the top of the meter to the wooden floor above. It was his duty to lock up the premises when the men left work. On the day in question, when he was locking up, he saw the Gas Company's men applying a light to the pipe from the meter. He asked them what they had been doing, as there was such a smell of gas. They said they had been blowing the pipes out, and this would account for the smell.

Cross-examined: If there had been any lighted gas near the meter when he left the works, he should not have noticed it, because it was a very bright day. The room over the meter was used as a timber store; and planing was carried on at the end of the room farthest from the meter. He had never seen matches lying about the premises; and smoking was strictly prohibited.

Henry George Campany, an engineer in the plaintiff's employment, said he lent a box of matches to one of the defendants' men on the day of the fire. He saw the man applying a light to the pipe above the meter. When he left the premises, as far as he knew, all was right.

Cross-examined: He had never seen any matches lying about on the timber.

Victor Payne, a joiner in the employ of the plaintiff, said when he was leaving the works he smelt gas coming from the vicinity of the meter.

William Henry Stammers, another joiner, saw the man applying a light somewhere at the top of the meter.

Edward Wingfield, an engine-fitter, deposed to having seen the fire shortly after it broke out. When he went into the works, he saw the flames coming in a column from the outlet-pipe of the meter, and going through the floor above. Part of the compo. pipe was burnt away. When he first saw the fire, it was confined to a hole of about 15 inches diameter above the meter. A man named Parker put a sack over the meter, and witness turned off the gas; but the wood floor was by this time alight, and they could not extinguish it.

Cross-examined: He had no doubt the fire proceeded from the outlet-pipe of the meter.

Charles Parker deposed to having seen the breaking out of the fire. The smoke, he said, was coming from under the eaves of the top storey. When he got to the meter, he saw flames issuing from the outlet. The lead pipe was nearly all melted away; and the flames were shooting up to the floor above, which was well alight. After endeavouring to extinguish the fire from below, he went up to the next floor, and saw the fire coming from the hole in the floor; but he did not see a trace of fire anywhere else. He afterwards went up a ladder, and broke the paint-room window. He saw smoke in the room, but no flame.

Cross-examined: When he broke the window, the paint-room was full of smoke; but he could see about the room. There was a stove in the room.

Re-examined: If there had been any fire in the paint-room, he must have seen it.

William Wingfield, a mechanical engineer, said he went to plaintiff's premises after the fire broke out. He corroborated the evidence of the previous witnesses as to the position of the outbreak.

Cross-examined: A certain quantity of gas must escape during the operation of putting the force-pump in position to blow out the pipe. A ¾-inch flame would have melted the solder at the union of the outlet-pipe, and so have caused an increased escape of gas in less than an hour. He did not agree with the suggestion that it would take eight hours. Witness then described the various experiments which he had made to test the length of time that would elapse between the ignition of an escape of gas at the union and the melting of the solder at the joint above. The quickest time in which he had obtained a flame such as was alleged to have caused the fire in the present case was 35 minutes.

Yesterday the evidence in the case closed; and Sir E. Clarke addressed the jury for the Company. To-day, Sir H. James will reply; and the Judge will sum up. We shall report next week the conclusion of the proceedings.

Shipley Local Board Water-Works.—The Shipley Local Board have decided to make application to the Local Government Board for sanction to the borrowing of £2750 for the completion of their high-level water-works.

The New Water Scheme for Belfast.—At a recent meeting of the Belfast Natural History and Philosophical Society, Mr. L. L. Macassey, Barrister-at-Law, M.Inst.C.E., delivered an exceedingly interesting lecture on the Mourne water scheme. He stated that the population of Belfast was about 280,000, of which 260,000 were within the borough proper. The quantity of water consumed by them was 36 gallons per head per day, which, though it looked liberal, was not in his opinion extravagant, considering it covered both domestic and manufacturing wants. Owing to the increasing population and requirements, the Water Commissioners determined to secure a supply of water which would enable them to meet any contingencies for some years to come. After a very painstaking comparison with other districts, the Mourne scheme was adopted. By their new Act, the Commissioners took control over 9000 acres of gathering-ground in the Mourne Mountain district, embracing the Kilkeel and Annalong rivers. The rainfall in this locality was considerably greater than that in Belfast. After making certain deductions, they based their calculations on a rainfall of 28 inches, which gave something like 16 or 17 million gallons of water per day. The gross consumption in Belfast at the present time was between 10 and 11 million gallons. It was proposed to construct in the Happy Valley a reservoir with a capacity of 2000 million gallons, and a water surface of 200 acres. The main conduit would be 34½ miles in length, of which 16¼ miles would be cut-and-cover, 12 miles steel pipes, and the balance (6¼ miles) tunnel. A service reservoir would be constructed 3 or 4 miles from Belfast; and this would have a capacity of 70 million gallons, or equal to a week's supply at the present rate. The estimated cost of the work was £750,000. A long discussion followed the lecture, at the close of which a hearty vote of thanks was passed to Mr. Macassey.

MISCELLANEOUS NEWS.

GAS UNDERTAKINGS AND THE RECENT DISPUTE IN THE COAL TRADE.

It will be seen, by the reports given below, that the gas undertakings in Lancashire and neighbouring counties have suffered considerable losses in consequence of the recent dispute in the coal trade.

At the meeting of the Birkenhead Town Council last Tuesday, the Gas and Water Committee recommended—"That from and during the two quarters ending on the 25th of March and the 24th of June, 1894, the price of gas to all consumers by meter be increased from 3s. to 3s. 4d. per 1000 cubic feet, with a rebate of 3d. per 1000 cubic feet as at present; making the net price of gas to such consumers 3s. 1d. per 1000 cubic feet during the two quarters." Alderman Bloor, in moving the confirmation of the Committee's proceedings, said the increase in the price of gas was rendered necessary in consequence of the recent coal strike. This year the Committee had been exceedingly fortunate in obtaining satisfactory tenders from the coal contractors; and they anticipated not only a surplus profit of £5000 to be handed over to the Finance Committee, but a further one of £2933. He had predicted the possibility of a concession being made to the gas consumers of the borough. That, however, had gone; and they had to face a deficit of nearly £6000. The Committee were already committed to an expenditure of £5557; and, as they had little or no stock in the works, it would be necessary to some extent to replenish it by going into the open market. As the price of coal had not come down to its old level, it was possible they woud have to pay something on this account; so that the sum of £5557 would most probably be raised to £6000, or even more. When the strike commenced, they had a stock of 6000 or 7000 tons of coal and cannel on hand. The quantity of coal purchased during the strike period was 11,257 tons, at a cost of £11,104; and of cannel, 1450 tons, at a cost of £1893. If they had used a sufficient quantity of coal and cannel at their contract price to have produced an equal quantity and quality of gas during the strike period, it would have cost £7440: so that the actual cost of the strike to the community had been up to now £5557. The Committee had a net deficiency of £3100 to meet; and they had decided to charge it entirely upon the gas consumers. They had done so because the extra expenditure had been incurred solely in their interest. Mr. Robinson moved, as an amendment, to refer the recommendation back to the Committee. He said he did not see that there was any obligation on the part of the Gas Committee to pay over £5000 to the Finance Committee, because the Chairman of the Committee should have to provide for whatever contingencies might arise during the year. It would be better, in his opinion, not to increase price of gas to the full extent of 4d., as it would stimulate the consumption of other lighting materials; and perhaps people would not go back to the use of gas. On a division, the amendment was lost; only the mover and seconder supporting it.

At the meeting of the Bolton Town Council last Wednesday, Alderman Miles, in moving the adoption of the proceedings of the Gas Committee, made a statement with regard to the loss sustained by the department in consequence of the recent stoppage in the coal trade. He said that, although they were very well supplied at the commencement of the strike, they had not sufficient coal to last them over the whole period. They had therefore been compelled to buy elsewhere, and at enhanced prices; the extra cost under this head being £6700. There had been besides a loss of at least £1200 to the department by reason of the reduced consumption of gas and the curtailment of pressure. The total decrease upon the year in the sale of gas had amounted to no less than 12,600,000 cubic feet. Against their losses they had had an increased value of nearly £2000 in the sale of coke, which would reduce the amount from £7900 to £5900. This would have a serious effect upon the profits when the next balance-sheet came to be issued. He was glad to say, however, that not a word had been uttered in Committee about raising the price of gas, as had been the case in many other towns. He was pleased that the Committee had been able to tide over a very difficult crisis without having to curtail the supply to the town or increase the price. Mr. Cooper agreed that the Committee had passed through a trying period. His pet scheme of a reduction in the price of gas by 2d. per 1000 cubic feet seemed now to have little hope of realization. He paid a compliment to Alderman Miles, as Chairman of the Committee, and suggested that the reserve fund should be increased so as to fully provide for such contingencies as a prolonged coal strike or loss from other cause. The Mayor (Alderman Nicholson), in paying his testimony to the zeal shown by the Committee during the recent crisis, said that at one time there was a probability of the town being in darkness. Thanks, however, to the energy displayed, this was avoided. In replying, Alderman Miles said there would be no need to draw upon the reserve fund unless something very serious happened. The question of the price of gas might, in his opinion, fairly be left to the proper time. The minutes were confirmed.

At the meeting of the Burnley Town Council last Wednesday, there was a short discussion as to the proposal of the Gas Committee to increase the price of gas from 2s. 9d. to 3s. per 1000 cubic feet to consumers within the borough, and from 3s. 6d. to 3s. 10d. to consumers outside; the discount in the former case for prompt payment being 3d. per 1000 cubic feet, and in the latter case 10 per cent. The increase had been recommended in consequence of the losses sustained by reason of the enhanced price paid for coal during the recent stoppage of the collieries. Alderman Thornber explained that the loss would be upwards of £4000; and this, with a previous loss by reason of the Oldham cotton strike, would probably wipe out the estimated profits. The proposed increase would take effect at Christmas; but if they did not have a strike in the cotton trade, the Committee might be in a position, at the end of the financial year, to reduce the price of gas to the old rate. Replying to a number of questions, Alderman Collinge said that they could not get any compensation from the contractors for coal, because the usual strike clause was inserted in the contracts. When the stoppage commenced, they had eight weeks' supply of coal, which was at the time considered sufficient. The minutes were approved.

The Darwen Town Council adopted yesterday week a recommendation of the Gas Committee that the price of gas for lighting purposes only should be advanced by 3d. per 1000 cubic feet from the 1st prox. The Chairman of the Committee stated that they had lost £1900 by the recent strike; and the proper way to meet the deficiency was to ask those who used the gas to help them to pay their way. The additional charge was not to apply to gas used for engines, stoves, and cookers; and the Committee would endeavour to remove it as soon as possible.

At the meeting of the Stalybridge Town Council yesterday week, the Gas Committee recommended that the price of gas should be raised from 2s. 10d. to 3s. 4d. per 1000 cubic feet for the quarter ending March 25, 1894. Alderman Ridyard stated that, in consequence of the non-delivery of coal under contract, the Committee were compelled to purchase about 2100 or 2200 tons, which cost an additional sum of £1030. The main reason for increasing the price by the large amount proposed was to meet the extra cost within the current year. It was hoped—and there were good reasons for the hope—that, by the end of the March quarter, they would be able to reduce the price to its original amount. The present contracts for coal would be spread over a longer period, because of the non-deliveries during the strike. Mr. Lees said he thought the Committee ought to take measures to encourage the use of gas for heating and cooking purposes, and with this object should have a permanent exhibition of stoves. The Mayor (Alderman Tinker) said it was an absolute necessity to push this question to the front. The Committee's recommendation was adopted.

At the meeting of the Walton Local Board last Thursday, Mr. Davies, in moving the confirmation of the proceedings of the Gas and Water Committee, stated that, in consequence of the coal strike, they had had to pay upwards of £1000 more for coal for the gas-works than would have been necessary had their contracts been adhered to. The Committee hoped, however, that, with careful management, they would not be compelled to raise the price of gas.

At the monthly meeting of the Warrington Town Council last Tuesday, it was stated that, although the Gas Committee had had to make extra purchases of coal, they would be able to tide over the difficulty caused by the coal miners' strike without increasing the price of gas. The loss to the Gas Department amounted to a sum reaching to nearly four figures; but the Committee would be just able to make ends meet, though the Finance Committee could not expect to receive much towards the relief of the rates. Mr. Fairclough pointed out that the Committee were able to carry on without increasing the price and without stopping the supply of gas mainly because of a purchase of cannel to which exception was taken in the Council when it was made. An accident at the South Wales colliery from which they bought their coal stopped the supply; and but for the cannel the town would have been in darkness.

According to a report presented by the Gas Committee of the West Bromwich Corporation at the meeting of the Town Council last Wednesday, the recent dispute in the coal trade had involved the Committee in very heavy expenditure; nevertheless they had decided to defer the consideration of making any advance upon the present prices of gas until the accounts for the financial year ending March 31 next had been audited. The Mayor (Alderman R. Farley), in moving the adoption of the report, stated that the strike had caused a loss of £1200 to the Committee. The report was adopted.

Speaking at the meeting of the Wigan Town Council last Wednesday, Mr. Holmes said that, owing to the foresight of their Gas Engineer (Mr. J. Timmins), they had a stock of 1200 tons of coal and cannel at the commencement of the coal strike. This was used with as much care as possible; and supplies were at once bought at the lowest price. They had, however, to pay from 50 to 60 per cent. more than the contract prices then; but, when the stock was exhausted, they had to pay nearly 200 per cent. more for supplies to keep the works going. It was a time of great anxiety to the Gas Committee; but, fortunately for them, one of the colliery owners, with whom they had a contract for 4000 tons of coal, recommenced work, and loyally carried out his engagement. Besides, he supplied them with coal at 50 per cent. advance upon contract price; and the Committee were grateful to him, as should be the ratepayers. The speaker mentioned that the loss to the department through the strike was £1500, which was, in his opinion, very small as compared with other boroughs in Lancashire.

THE LIVERPOOL CORPORATION AND THE GAS COMPANY.

The Appointment of an Auditor of the Company's Accounts.

A discussion took place at the meeting of the Liverpool City Council last Wednesday on the subject of the appointment of an Auditor of the accounts of the Liverpool Gas Company. The duties of this office have for some years been discharged by Mr. P. B. M'Quie; but as he has expressed a wish to retire, the question of a successor had to be considered. The names of two gentlemen—accountants of high standing in the city—had been suggested; but the Watch Committee submitted a recommendation to appoint Mr. R. Barrow, Chief Auditor in the Accountants' Department of the Corporation, to fill the position. During the discussion, some insinuations were thrown out by one speaker that, as Mr. M'Quie was "paid for professional services by the Gas Company, his leaning would be towards them as against the Corporation." Taking into consideration the increased price of gas, it was, he said, advisable that they should have a more thoroughly independent audit; and if they had it he believed their gas bills would be considerably reduced. These imputations were protested against by Sir W. Forwood and Mr. Hornby; the latter explaining that the Company were compelled by statute to pay the Corporation Auditor for his services. Mr. Williamson said he took the responsibility, as the person upon whose initiative the recommendation had been made. The price of gas in Liverpool was wholly anomalous, as compared with Birmingham, Manchester, Newcastle, and Nottingham. The increase of 4d. which the Company now proposed to put on, meant £52,670 a year to the public; and, since the Corporation alone paid the Company £40,000 annually, they were entitled to exercise freely their right to appoint an Audior. Mr. Barrow ought to fill the position, if only for one year, in order at least to get to the bottom of the statements made that large sums had been charged by the Company to revenue when they ought to have been charged to capital account. By Mr. Barrow's appointment, they would get at the truth of the matter. Alderman Radcliffe, who had moved to refer the recommendation back to the Committee, said that, after the explanation which had been given, he would not press the matter to a division, but would be willing that the appointment of the City Auditor should be tried for one year. The recommendation was accordingly agreed to.

At the City Sessions on Friday, Mr. Segar appeared, on behalf of the Corporation, to apply to the Recorder (Mr. C. H. Hopwood, Q.C., M.P.) that Mr. Barrow should be appointed to audit the accounts of the Gas Company. He explained that Mr. Barrow was familiar with the proper method of separating capital charges from those which should be borne by revenue; and this was exceedingly important, as one of the objects of the Legislature was to prevent gas companies from charging more than 10 per cent. upon anything that did not properly belong to capital. It was therefore essential that the accounts should be examined with the greatest thoroughness; and the Corporation had every confidence in Mr. Barraw. The Recorder remarked that he had been for years in the habit of appointing a certain gentleman as Auditor of the gas accounts, with the full concurrence of the Corporation and the Company. Before he consented to Mr. Barrow's appointment, he must have substantial reasons given to him why a change was desirable. Mr. Segar said he understood the Corporation were desirous that Mr. Barrow should be entrusted with the duties. The Recorder replied that this was possible, but that it did not rule him entirely. An application by the ratepayers, with the concurrence of the Corporation, would have the greatest weight with him; but, at the same time, he did not wish to do any injustice. After some discussion, it was decided to postpone the further consideration of the matter until later in the day, by which time Mr. Segar would be able to submit affidavits showing why the change in the auditorship was sought. At the hour specified, the Recorder heard the application in his private room; and, after listening to Mr. Segar at considerable length, he announced that he would give his decision on the following day. The Recorder gave his decision on Saturday. He said he had taken time to consider it, and had now come to the conclusion that he would accede to the request on behalf of the ratepayers, who desired the appointment of Mr. Barrow. He had a feeling of reluctance to make a change in the auditorship, because, so far as he could judge, Mr. M'Quie had all the qualifications for discharging the duties which had been first assigned to him by his (the Recorder's) predecessor, with the approbation of all concerned.

NEWCASTLE-UNDER-LYME GAS SUPPLY.

The Local Government Board and Payments from Gas-Works Loans.

At the Meeting of the Newcastle-under-Lyme Town Council last Tuesday—the MAYOR (Mr. Alderman S. Hyslop) presiding—the Town Clerk read the following letter from the Local Government Board: "I am directed by the Local Government Board to acknowledge the receipt of your letter of the 28th ult. with reference to the proposal of the Town Council to defray out of the loan moneys the additional remuneration which has been granted to the Gas Engineer for special services in connection with the execution of works of gas supply; and I am to state that the Board cannot regard such payment as expenditure which could properly be defrayed out of the borrowed money. The loans to which you refer in your letter are sanctioned to cover the cost of the particular works in respect of which such loans were stated to be required; and no payments can properly be made out of them for any other purpose. I am to add that it will be necessary that the loans of £6500 and £1700 should be recouped forthwith out of the rates the amounts which had been appropriated from them towards the remuneration of the Gas Manager. I am to request that the Board may be informed when this has been done."

Mr. R. RATCLIFFE said the Local Government Board had sent him a copy of the letter from the Council and the Board's reply; and he expressed regret that he had to complain of the illegal way in which the Gas Committee had been conducting their business. Although the Gas Manager (Mr. W. Winstanley) was only appointed Engineer for the new works in November, 1892, he received the first year's extra salary of £100 in February, 1893; a cheque being drawn for him by three members of the Gas Committee, without the sanction of the Council, and paid out of the loan moneys. These members had not the courtesy to bring the matter before the Gas Committee for them to consider whether it was a right and just act. It was not known that such a thing had been done at the time; and there was no entry in the minutes to tell them—in fact, it was a great surprise to the members of the Council that such a thing should have occurred without their sanction. There was no authority for the payment of the cheque on the minutes; and the £100 was paid to Mr. Winstanley as a full year's remuneration before he had done three months' work. The Municipal Corporations Act provided that all committee minutes, before they could be acted upon, must be confirmed by the Council. It was his intention to immediately draft a letter to the Local Government Board, and explain to them the whole facts and the resolutions passed, and call their attention to matters in which they (whom he was addressing) had gone against the provisions of the Act. They had promised faithfully never to overdraw their banking accounts, and never to give any contracts for amounts of over £100 without advertising for tenders; but it was not long since that they sent work to the extent of £150 from the gas-works without advertising it, while another tender was lying on the table, and was never opened. They were giving work practically to foreigners when they had a tender from a local man who would have done it for £33 less. He moved that the letter from the Local Government Board be referred to the Gas Committee.

Mr. W. O. BRIGGS remarked that the letter which had been read was directly in opposition to the opinion expressed by Colonel Luard when he held the Local Government Board inquiry; and it was a matter which would require to be very carefully considered in Committee. He

proceeded to remark that Colonel Luard asked Mr. Ratcliffe at the inquiry if he would have objected to the payment of the £100 out of the loan moneys if it had not been Mr. Winstanley, but someone else who had been appointed Engineer; and Mr. Ratcliffe replied that he would not. The letter of the Board had taken him somewhat by surprise.

Mr. H. G. BROOMFIELD seconded the motion.

Mr. RATCLIFFE subsequently made an addition to his motion, to the effect that the letter be fully considered at the General Purposes Committee before any reply was sent to the Local Government Board. He thought the whole of the members of the Corporation should have a voice in it.

The resolution was unanimously carried.

THE WORKING OF THE MANCHESTER CORPORATION GAS UNDERTAKING.

With the view of raising a discussion in the Manchester City Council on the "unsatisfactory position" of the gas undertaking Mr. Southern has prepared an elaborate "Memorandum," and circulated it among his fellow-members, comparing the results of the working with those realized by six other Corporation gas undertakings. The following is the text of the document:—

Rather more than twelve months ago, I called the attention of the Chairman of the Manchester Corporation Gas Committee to the very unsatisfactory position of the undertaking, judged by the results of its working in comparison with other large towns in which the gas-works were managed by Corporation Committees. I suggested the means by which Manchester might be placed in a more creditable position. Little, if anything, has been done to secure better results. I now feel it my duty to place the comparative facts and figures before the members of the Council. I propose on a suitable occasion to raise the question of gas management in the Council; but it is not easy to place statistics before a meeting in such a way that their force and meaning may be immediately apprehended. This "Memorandum" will supply the material upon which a sound and independent judgment may be formed. The figures quoted are from the annual publication known as "Field's Analysis." They are authentic, and may be considered reliable. I do not propose to institute comparisons with places where the gas-works are in the hands of private Companies—as they are in London, Bath, Brighton, Bristol, Derby, Liverpool, Newcastle, Plymouth, Portsea, Preston, and Sheffield. The working of these Companies is included in the tables of the "Analysis;" but to include them here would simply embarrass by extending the statement, while deductions drawn from them might not be considered fair. In the following places, the works are in the hands of the Corporations, and with these comparisons may fairly be made: Birmingham, Bolton, Leeds, Leicester, Manchester, Nottingham, Oldham, and Salford.

In considering the conditions of economic working, the first point to be noted is the capital charge upon which interest must be paid before profits can be earned. With a heavy dead-weight of extravagant and fruitless expenditure on capital account, the most careful management may fail to bring out satisfactory results. The Gas Committee have nothing to complain about on this head. If any concern can boast of a satisfactory capital basis, it is the Manchester gas undertaking, as the following figures will show:—

	Capital upon which Interest has to be Paid.	Per Ton of Coal Carbonized.	Per 1000 Cub. Ft. of Gas sold.
Birmingham	£2,006,034	£4 6s. 2d.	10s. 0d.
Bolton	547,806	7 1 3	15 0
Leicester	771,732	7 1 3	13 11
Manchester	681,582	1 18 10	4 4
Nottingham	902,828	6 11 8	13 6
Oldham	349,880	3 13 11	7 9
Salford	461,174	4 9 4	9 7

The figures for Leeds are not given for the past year; and for this reason I leave Leeds out. In the figures I gave the Chairman last year, Leeds was included; the omission does not affect the comparison.

Two conclusions may be drawn from this table: (1) That the property has been depreciated too heavily. (2) That the expenditure on renewals and improved plant has been unduly curtailed. Probably both are true. In any case the undertaking is placed on a favourable footing for economical working. The advantage in working which this low capital charge affords, is illustrated by the following comparison of the amounts paid for interest on capital for every 1000 feet of gas sold:—

	Amount.	Per 1000 Cub. Ft.
Birmingham	£94,041	5·61d.
Bolton	20,550	6·75
Leicester	26,643	5·77
Manchester	24,853	1·89
Nottingham	41,614	7·49
Oldham	11,928	3·16
Salford	15,822	3·93

I want to dissociate management from any questions of price charged for gas; but it is only fair to show that the price charged in Manchester is the highest in the list, with the single exception of Bolton, and the amount handed over in aid of rates per 1000 cubic feet is less than either Bolton, Leicester, or Nottingham.

	Price per 1000 Cub. Ft.	Net Profit handed over in Aid of Rates.
Birmingham	2s. 2d.	1·91d.
Bolton	2 8	5·37
Leicester	2 3	4·41
Manchester	2 7	4·22
Nottingham	2 5	4·32
Oldham	2 2	0·32
Salford	2 4	1·82

The figures given so far indicate the initial advantages which Manchester possesses; those which follow will indicate how these advantages are frittered away. The table given below shows the quantity of gas made per ton of coal carbonized, the illuminating power, and the percentage of cannel used:—

	Feet per Ton.	Candle Power.	Cannel. Per Cent.
Birmingham	9,319	17·22	1·51
Bolton	9,826	17·91	9·48
Leicester	10,436	17·01	6·99
Manchester	9,684	19·55	59·72
Nottingham	10,451	18·25	39·11
Oldham	10,204	19·69	8·02
Salford	10,223	18·78	30·72

It may be fairly said that, in a well-conducted gas-works, there should be a production of 10,000 cubic feet per ton. In some of the concerns worked by private Companies, as in Brighton and Plymouth, the production is considerably above 11,000 feet per ton. In the matter of illuminating power, Manchester stands high, although, with a proportion of cannel of 8 per cent., Oldham produces a higher illuminating power than Manchester with its proportion of 59 per cent.

It is, however, in dealing with the residuals that the management of the Manchester Gas-Works is the most susceptible of improvement. Taking the articles of coke, tar, and ammoniacal liquor in order, the comparison stands as follows (leaving out the fractions of pence):—

	Coke.	Tar.	Liquor.
Birmingham	2s. 10d.	1s. 0d.	1s. 2d.
Bolton	2 5	2 1	1 6
Leicester	3 8	1 4	1 3
Manchester	2 3	1 11	1 4
Nottingham	3 1	2 1	1 6
Oldham	1 10	2 2	1 2
Salford	2 5	1 6	1 2

The total amount received for residuals per ton of coal carbonized, and its percentage on the cost of coal, are shown in the following figures:—

	Per Ton of Coal Carbonized.	Per Cent on Cost of Coal.
Birmingham	5s. 0d.	44·97
Bolton	6 1	50·30
Leicester	6 3	52·27
Manchester	5 6	41·23
Nottingham	6 8	60·57
Oldham	5 2	38·40
Salford	5 1	42·65

In consequence of the large proportion of cannel which, as already shown, is most unusual, the cost of material is, as might have been expected, much higher in Manchester than in most of the other towns. Reckoned in proportion to the gas sold, it appears that for every 1000 feet of gas the amount paid for the material, after deducting residuals, is as shown in the following table (column 1), and the net cost per ton of coal, after deducting receipts for residuals, in column 2.

	Net Cost of Material per 1000 Ft.	Cost per Ton deducting Receipts for Residuals.
Birmingham	8·6d.	6s. 2d.
Bolton	7·6	6 0
Leicester	6·7	5 9
Manchester	10·4	7 10
Nottingham	5·3	4 4
Oldham	10·4	8 3
Salford	8·8	6 10

The significance of these figures may be seen by calculating the difference upon the quantity of material used. Thus, the total quantity of material carbonized in Manchester is somewhat over 351,000 tons. If by buying as well, extracting as completely the residuals contained in the coal, and turning them into money, instead of leaving them as impurities in the gas, or wasting them in the process of manufacture, Manchester could reduce the cost of its coal, less the receipts from residuals, to the same level as Nottingham, it would make a money difference, to the advantage of the Corporation of Manchester, of no less than £61,425 per annum; and if to the level of Leicester, a difference of £36,562 per annum. It might, however, be considered unfair to compare Manchester with these two Midland towns, because of the higher price given for coke in these towns; but it is fair to assume that at least a portion of this increased value is owing to discrimination in the purchase of material and management in producing a superior quality of coke. There can be no unfairness, however, in comparing Manchester with the neighbouring towns of Bolton and Salford. If Manchester did so well as Bolton, it would save £32,175 per annum, or if so well as Salford, £17,550. To sum up, Manchester pays for its raw material 1s. 5¾d. per 1000 feet of gas sold, against an average for the six towns named of 1s. 3¼d. It receives for its residual products 5s. 6d. for every ton of coal carbonized, against an average for the six towns of 5s. 8d. It has to bear a charge for interest on capital of less than 2d. per 1000 feet, against an average of about 5¼d.

If these are facts, and I believe they are, then I conclude that it is the duty of the Gas Committee to call in the advice of a fully-qualified scientific man to point out the defects in their working and administration, and the changes necessary to place Manchester where it ought to be—in the foremost place, and not, as it now is, in the hindmost, in this most important department of Corporation enterprise.

BIRMINGHAM CORPORATION GAS SUPPLY.

The Assessment of the Works—The Increase in Price—The Interpretation of the Strike Clause in the Coal Contracts.

At the Meeting of the Birmingham City Council last Tuesday—the MAYOR (Alderman Johnson) presiding—the Gas Committee submitted a report in which it was stated that they had received notice of very largely increased assessments in the Parish of Birmingham. Believing these assessments to be excessive, they had given notice of their intention to appeal against them; and, by arrangement with the overseers, the hearing of the appeal had been deferred until the new year. The Committee had entered into communication with the overseers with a view to obtaining a reduction in the assessment, in order to prevent the necessity for prosecuting the appeal. They also announced the death, on Oct. 9,

of Mr. D. P. Mudie, formerly Superintendent of the Swan Village works, to whom a retiring allowance of £100 per annum was granted by the Council in May, 1891. With reference to coal, the Committee reported that they received notices from all the coalowners supplying them under contracts to the effect that, owing to cessation of work, supplies would terminate from July 28 last; and they were wholly suspended shortly after that date. Subsequently the delivery of a portion of the supplies was recommenced from districts in which work was resumed. At the time the supplies were stopped, the Committee had a stock of coal amounting to 76,000 tons; and on Nov. 16, when the strike ended, it had been reduced to 22,000 tons. In the meantime, purchases had been made of about 65,000 tons for current requirements, and for the maintenance of the supply to the end of December. In order to obtain the coal on favourable terms, it was also necessary to extend the purchases into the coming year; and 5000 tons were bought for delivery in January and February. Early in November, it became apparent that, owing to arrears accumulating on contracts on which deliveries had been resumed, and to arrears on the new purchases, it would be necessary to buy further coal to maintain the supplies to the early part of January; and a further quantity of about 35,000 tons was then purchased, but of this 9000 tons were for delivery in January and February. The cost of these additional purchases, over and above the contract prices for the year, was estimated at £24,000, so far as could at the present time be ascertained. Having regard to the increased expenditure which had been necessary to meet the difficulties of the coal strike, and to the diminished output of gas during the past half year, the Committee said they had had to reconsider the financial prospects of the undertaking; and, as a result, they recommended—"That the price of gas to private consumers be increased by 3d. per 1000 cubic feet, and for public lighting in proportion, from the next quarterly reading of the meters."

Alderman POLLACK, in moving the adoption of the above recommendation, said the outcome of the past two years' trading had not been favourable; and last year it was only possible for them to pay their usual contribution to the improvement rate by suspending the ordinary provision for maintenance and renewal of works, and the instalment for sinking fund. The Committee probably made a mistake in not increasing the price of gas at that time; but, for reasons which he stated to the Council, they hesitated, and waited in the hope of such a course proving unnecessary. To enable the members to understand their position, he would briefly recapitulate some of the principal items of their increased expenditure in the last financial year, as compared with 1888, which he selected because coal was then lower than it had been since, and the hours of labour at the works had not been altered. The difference in what they had to pay for coal in the last financial year, when it had somewhat fallen in price, and the year 1888, calculated on the cost per 1000 cubic feet, was £73,000. From this they had to deduct the increased yield from residuals, which, reckoned in the same manner, was £6000; leaving a net increase of £67,000. To this they had to add the relative increase for manufacture and distribution wages alone, due to the adoption of the eight-hour shifts, granting of holidays, and other concessions to the men—viz., £17,500; also the cost of improving the purification, calculated upon the increased output as compared with 1888, £8500. These three items of additional expense made a total of £93,000. But as the profit in 1888 was £55,000, as against £28,000 last year, the difference of £27,000 should be set against this sum, as also some improvements in manufacture and other savings, which might be estimated at £15,000, forming a total of £42,000, and reducing the increased expenditure of 1892 as compared with 1888 to £51,000. This increase would have been sufficient to warrant the Committee in recommending a rise in prices in the spring; but they were aware that a higher price meant reduced consumption. It would stimulate the adoption of electricity; and they were unwilling to add to the heavy burden of those ratepayers who were gas consumers at a time when the rates had been much increased. On the other hand, they hoped to make a considerable profit in the present financial year from three sources. The first, from ammoniacal liquor; the second, from increased consumption of gas; and the third, from the reduction in the price of coal. While it appeared that they were justified in expecting an increased revenue from ammoniacal liquor, the consumption of gas, instead of increasing, had been decreasing, owing to the phenomenal weather, and, perhaps, to slackness of trade; while, in the third place, the advantage which they might have gained from their new coal contracts had been nullified by the coal strike. As the report stated, their additional expenditure due to the strike had been £24,000. This was really a small sum in comparison with the loss entailed in connection with other important gas undertakings. Though they might call upon the coalowners who had entered into contracts to supply the arrears which had accumulated during the strike, it had been necessary for the Committee to look forward, and to make provision by new purchases for some time ahead. Of course, it was a great disappointment to them to have to make this recommendation for increasing the gas charges, because during the last two or three years, while almost every Corporation Gas Committee had been increasing their prices, it was their pride in Birmingham that they had not followed the example. When, however, it was recollected that the price of coal had risen by nearly 40 per cent. compared with 1888, that owing to the adoption of eight-hour shifts they had incurred a large additional expenditure in wages, and, finally, the extra outlay owing to the coal strike, it would be seen that it was impossible for the Committee to recoup the loss incurred without the increase recommended.

Mr. ALLEN remarked that some time ago the Committee considered the desirability of increasing the price of gas, but decided against it, because they feared the consumption would decrease, owing to the competition of other illuminants. Did not, he asked, the same argument hold good to-day? The increase would press very hardly upon the small consumers; and he thought they should consider if some means could not be devised of putting the burden upon those who were better able to bear it.

Mr. BLOOR said he should vote against the increase, unless some further information was imparted. Was there not any possible chance of making the coal contractors fulfil their contracts, or compensate the Corporation for the loss sustained by their non-fulfilment? Otherwise the Council, in voting for the increase, would really be voting for the indemnification of the colliery proprietors.

Mr. BEALE hoped that the Town Clerk would not be pressed for an answer to the question as to the liability of the contractors. To give such advice in open Council might defeat the very object Mr. Bloor had in view. The Committee were well aware of the serious question arising out of the strike clause in the contracts as to the difference between a "strike" and a "lock-out," and had already referred it to the Town Clerk.

The TOWN CLERK asked to be excused giving an opinion in public on the point raised; it being an exceedingly difficult matter. Apart from the question of a strike, if a contractor failed to deliver according to his contract, the Committee could buy against him; but in this case the question of the interpretation of the strike clause came in. Another point that came in when dealing with gigantic contracts of this kind was the solvency of the contractor.

Mr. BLOOR observed that, if this question were being dealt with, the Committee should defer asking for an increase in the price of gas until it was settled.

Mr. STEVENS said, if the price were not increased, the Committee would be unable to make the usual contribution to the improvement scheme; and the ratepayers would suffer. He was glad Mr. Bloor had spoken in favour of the Corporation attempting to secure compensation from the contractors. The action of the Corporation ought not to be affected by any fear of driving the contractors into the Bankruptcy Court. If the men had struck for an increase of wages, the case would have been different. The contractors, however, made the contracts knowing very well that they could not supply the coal at the prices at which they tendered, unless the men submitted to a reduction of wages. This was a commercial swindle; and something ought to be done to show that the Council would not tolerate that kind of thing.

Mr. JACOBS and Mr. POWELL suggested that it was not quite fair to tax the gas consumers for the benefit of the whole of the ratepayers.

Alderman CLAYTON pointed out that it was settled, when the gasworks were taken over by the Corporation, that the Gas Committee should contribute something out of the profits in relief of the rates. It was intended that the contribution should be £30,000 a year; but that expectation had only once been realized. As the ratepayers would have to bear the loss if ever the gas-works were superseded, or partially superseded, it was but fair that the consumers should "pay the piper" now, and thus insure the ratepayers against possible loss in the future.

Alderman KENRICK, M.P., said that, if the contractors could be shown to be liable, the Committee would certainly seek compensation. In the meantime, however, the Committee had had to buy 65,000 tons of coal at an enhanced cost. [Alderman POLLACK: 100,000 tons.] Probably the increase in the price of gas would favour the competition of electricity and other illuminants; but there was no sufficient reason why the gas consumers (many of whom were outside the city) should have cheap gas at the expense of the ratepayers.

Alderman POLLACK, in reply, said, as soon as the Committee thought it safe to do so, they would recommend a reduction in the price of gas; but there was no immediate prospect of this—the probability being that they would have to pay more for coal than they had hitherto done. With respect to the position of the Committee in regard to the contractors, he assured the Council they were quite as anxious to see that justice was done to the ratepayers as Mr. Bloor could be. One of the main reasons adduced when the gas-works were purchased was that the undertaking should make a contribution to the rates; and he considered that no injustice was being done to the consumers, for the price of gas in Birmingham was lower, he believed, with one single exception, than was charged by any other Corporation in the country.

The motion was then carried with only five dissentients; and subsequently the remaining portions of the report were adopted.

INCREASE IN THE PRICE OF GAS AT LEEDS.

At a Special Meeting of the Leeds City Council last Wednesday, the following recommendation of the Gas Committee was under consideration: "That the Council increase the price of gas to consumers within the city of Leeds from 2s. 2d. to 2s. 4d. per 1000 feet, and to consumers outside the city from 2s. 10d. to 3s. per 1000 feet, such increase to take effect on the 1st of January, 1894."

Alderman GILSTON moved the adoption of the proposition; and, in doing so, he explained that it was necessary owing to the increased price paid for coal during the recent lock-out. During that period, coal had to be obtained from Durham and elsewhere, which entailed an increase upon their contract prices of about 7s. 2d. per ton; and the quantity they had to purchase was sufficient to make £26,369 above what they would have had to pay for the coal at the contract rate. Then they had to pay £1931 for additional labour during the same time. On the other hand, they sold coke at an increase of 35 per cent., making £3679; so that a loss was suffered by the lock-out of £24,621. He proceeded to state that other great towns had had for the same reason to increase the price of gas, and showed that, but for the coal difficulty, there would have been considerable profit this year from the undertaking. During the year ending June 30 last, there was a gross profit of £16,986; and, after £10,218 had been deducted for the sinking fund, there remained £6768 to go towards the reduction of the accumulated deficit. But for the greatly increased price of coal during the lock-out, he had no hesitation in saying that, at the end of next June, there would have remained very little of the deficit to be cleared off. A loss of £24,000 was not equal to the loss that had been sustained in many a year by the reduction in the price of tar and ammonia. With the accumulated deficit of years to meet, together with the loss of £24,000 by the coal strike, it would be wise not to battle with the deficit any longer, but to clear it off with the least possible delay. Even if the price was increased as was proposed, the gas would still be below that of Birmingham and Manchester. [Mr. IRWIN: In candle power.] Candle power, retorted Alderman Gilston,

is a term more easily used than understood. Within the last eight years, the Corporation had paid no less than £100,000 for increasing the illuminating power of the gas by a single candle; and no man had been the wiser after it had been spent. As to the complaints of the quality of the gas, it was 18-candle power; while in Birmingham it was only 17¼ candles. He added that the Committee were now getting coal at contract price, and that it was coming in freely; and he hoped, as they worked off the present stock of Durham coal, the illuminating power would be improved.

Mr. HARLAND, in seconding the motion, remarked that very great credit was due to the Gas Committee for keeping the town supplied with light during the coal strike.

Alderman SCARR desired to know what was to become of the £30,000 of debt which had accumulated before the coal strike, besides which there was the £11,000, the cost of the abolition of the gas-meter rents, to be provided for. He reminded the members that, during the last three years, there had been an increase of 4d. per 1000 cubic feet in the price of gas, and submitted that the Committee ought to have struggled with their difficulties, and not recommended a further increase.

Alderman HENRY and Mr. LOWDEN both agreed that Alderman Scarr's remarks showed that he was utterly ignorant on the question; and they supported the proposed increase.

Mr. GORDON hoped that, if the advance of 2d. did not prove to be enough, the Committee would further raise the price. When they reached a figure which would enable them to get rid of the deficit, he trusted they would not run down the price too quickly; so that in the future they might accumulate a reserve fund, by means of which they would be able to meet times of trial like the present.

Alderman GILSTON enumerated some of the difficulties the Committee had had to contend with during the last six years in connection with the reduced price of residuals and the increased price of coal. He said the additional 2d. in the price of gas would cover the cost of abolishing the meter-rents, and leave a considerable balance to relieve the deficit, which, he hoped, would in a few years be entirely wiped off.

The resolution was adopted, only a few members voting against it.

BLACKBURN GAS AND WATER SUPPLY.

The Proposed New Gas-Works—Additional Capital for the Gas and Water Undertakings—Compensation for the Gas Explosion.

As briefly mentioned in the JOURNAL last week (p. 1051), an inquiry was held at Blackburn on the 1st inst., by Major-General H. D. CROZIER and Mr. E. P. BURD, on behalf of the Local Government Board, into an application made by the Corporation for power to borrow additional money for the purposes of their gas and water undertakings, for the payment of compensation in respect of the gas explosion at the Crown Hotel in November, 1891, and for erecting additional works for the manufacture and storeage of gas. Particulars of the proposed new works have already appeared in connection with our notice of the report of the Gas Engineer (Mr. S. R. Ogden) thereon.

The TOWN CLERK (Mr. R. E. Fox), in support of the application, stated that, under the first head, it was originally proposed to borrow £7000 to meet the ordinary capital expenditure in connection with the gas-works; and, under the second head, to raise £14,000 to meet the expenditure arising out of the gas explosion which occurred in the town in 1891. It was now found necessary to increase the borrowing powers under the first head from £7000 to £20,000. Of this sum, £15,000 was for the estimated amount required to provide for mains, meters, and services, for a period of five years. In 1889 the Corporation were granted by the Local Government Board a Provisional Order, enabling them to borrow £10,000 for extensions; but they expended £1996 above this amount. They also required £1200 to complete the work in connection with the erection of a new gasholder, the contract for which amounted to £12,644. The work was finished. It was absolutely necessary to provide a new holder at the No. 2 station, as they had been working at high pressure; and they had to make provision for storeage. With regard to the gas explosion (particulars of which he gave), they asked power to borrow £14,000 for a period of 15 years, to meet the claims arising out of the accident. Referring to the water-works, Mr. Fox said the Corporation asked power to borrow £10,000 for ordinary purposes. This was one of the cases in which they had been unavoidably obliged to spend money. The Water Department had obtained and expended £10,000; but they had exceeded this amount by £3992. He now proposed to increase the sum asked for to £20,000 for a period of ten years.

Alderman W. THOMPSON, the Chairman of the Gas Committee, and Alderman HOYLE, the Chairman of the Water Committee, supported the applications in regard to their respective departments.

The TOWN CLERK next dealt with the application for power to borrow £150,000 for the erection of new gas-works. Explaining the necessity for the proposed works, he said there were already two gas-making stations in the town. The first (known as No. 1 works) was originally erected for a maximum make of 750,000 cubic feet of gas per day; the second (No. 2 works), for 1,500,000 cubic feet per day. In 1891, however, the actual make at No. 1 works was 916,000 cubic feet; and at No. 2 works it was 2,000,035 cubic feet. They were, therefore, making 36 per cent. more than they were designed for. This meant that for the past few years the works had been carried on under pressure, and with more wear and tear than there ought to have been. The area supplied by Blackburn gas was a very large one, and included a number of townships beyond the borough boundary; the farthest point being some five miles. During the last eight years, there had been an increase of from 54 to 55 per cent. in the actual quantity of gas accounted for. The site of the proposed works had been selected because of its proximity to the railway; and it was proposed to construct a siding, enabling coal to be brought direct from the pits to the works. This would effect a great saving upon the present system of carting coals from the railway. With regard to the area of the site (41 acres), the Corporation were in this position: The vendor of the land was not disposed to sell less than the whole of his holding, because the erection of the gas-works would probably prejudice him in selling the remainder. The land would probably not be more than would be required; and it was offered at £600 an acre, to include mines and minerals. At the end of the town where it was proposed to erect the new works, the demand for gas had increased very much during the last few years; and it was considered an advantage to have the extension there.

Mr. *E. H. Stevenson*, M.Inst.C.E. (of the firm of Messrs. Stevenson and Burstal, of Westminster), was called, and confirmed the statement of the Town Clerk as to the increase in the consumption of gas in recent years. He described in detail the construction of the proposed works, and calculated that 1s. 6d. per ton of coal would be saved in cartage by making the siding from the railway. He also explained that it was proposed to discontinue No. 1 works, and convert the site into an electric lighting station. The Corporation had obtained borrowing powers for £50,000 for electric lighting purposes, and were now considering tenders.

Mr. *Bailey*, the Borough Treasurer, said the total amount authorized and raised in respect of the gas-works in the borough was £622,093. Of this sum, £30,261 was repaid; leaving a net debt of £591,838. The rateable value of the borough was £433,244; and the population was 122,300.

The TOWN CLERK said he was instructed to ask the Local Government Board the longest possible term of years for the repayment of the loan applied for; and it was also desired that the period allowed should be the same for land as for works. The term he asked for was 50 or 60 years; and he pleaded special reasons. Under the various Local Acts by which the Corporation had contracted their capital debt on the gas-works, they had in the past had long terms of years allowed for repayment. Under one Act they had 80 years; and under another, 60 years. It would be very inconvenient if 50 years were allowed for the land, and only 30 years for the works, as it would involve different accounts and separate sinking funds.

Major-General CROZIER remarked that the Board did not allow more than 30 years for buildings of any kind—even a town hall.

Mr. BURD pointed out that the electric light might make such strides during the next 30 years that the gas-works would at the end of that time be almost useless.

Major-General CROZIER said he would put the matter before the Local Government Board; but he would not like to buoy up the Corporation in the belief that they would get what they asked. It was likely, however, that the period allowed would be the same for both works and land.

The inquiry then terminated.

THE LONDON COUNTY COUNCIL AND THE METROPOLITAN WATER SUPPLY.

At the Meeting of the London County Council last Tuesday, the Parliamentary Committee reported that they had had under consideration a resolution of the Council declaring that it was desirable that the Council should obtain powers for the acquisition of such areas as might be needed for the supply of water to the Metropolis, together with powers of supply. The Committee were advised that there could be no practical scheme of supply by the Council direct to the water consumers until the Council had obtained possession of some water for supply, or were applying to Parliament for power to appropriate some water for the purpose. This would involve either the purchase of the existing Companies' undertakings, or some of them, or new powers for the construction of works and the diversion of water from some river or streams, which could not be effected otherwise than by parliamentary sanction, after plans and sections had been deposited, and ordinary notices given. Moreover, no Bill could be framed to deal with giving the Council powers of supply until it had been decided on what terms and on what principles of charge the supply should be afforded, nor until after the existing position of the Water Companies had been fully considered by the Council, so that instructions might be given as to the principles upon which the rights of the existing Companies should be dealt with. In view of the difficulties involved, the Committee requested the Water Committee to meet them in conference; and the combined Committee came to the conclusion, *nem. con.*, that no practical scheme comprising powers of supply could be included in the projected Bill. They had accordingly framed a Bill to empower the Council to purchase or acquire, as opportunity might offer, any areas or water rights, the possession of which they might regard as likely to be valuable in the future. They now recommended the Council to approve of this Bill. The adoption of the report having been moved, Mr. Westacott inquired what grounds the Committee had for the statement in the preamble of the Bill that "it appears that the existing means of water supply are inadequate." He said the Royal Commission stated in their report that the supply was adequate for 40 years. Mr. T. M'Kinnon Wood (the Vice-Chairman of the Committee) said the statement was based upon the report of the Water Commission; and he personally was of opinion that 40 years was a short time for such a task as was contemplated. Mr. Westacott ridiculed the proposal to bring in a Bill which did not specify the land to be acquired. No corporation had ever been permitted to establish a supply in competition with the existing one; and the right way was for the Council to negotiate for the acquisition of existing properties. Sir J. Lubbock said he thought Liverpool should have gone to Westmoreland for water. Last session Parliament gave another slice of suitable high gathering-ground to Birmingham. If London remained quiet for a quarter of a century, all such grounds in the country might be taken possession of. It was of the greatest importance that the Council should be able to acquire suitable lands for water supply. Mr. Beresford-Hope said the Bill could do no harm. It would enable the Council to get the power of holding land and easements for water supply, which other corporations held under the Public Health Act. They might, if they chose, acquire sources of supply and lease them to the Water Companies for the present, so that they would not have to re-purchase them in the future at a greatly increased value. The report was adopted.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Lord Provost Bell, at the meeting of the Glasgow Town Council on Thursday, gave a *résumé* of the work of the Council during the past year. Dealing with the gas and electric lighting department, he said that their electric lighting plant was intended to supply 12,000 lamps of 8-candle power; but that, so great had been the demand for the new illuminant, that as many as 15,000 lamps had been supplied, and the number of consumers was still increasing. They had, in consequence, given authority for the provision of additional plant. His Lordship, referring to the new gasholder at the Temple Farm station, said it would greatly assist the Corporation to cope with the extra and sudden demand which always took place during foggy days in the winter months. Many improvements had been introduced into the various gas-works during the year, which would result in economy in the production of gas. His Lordship might well say so; for the Corporation gas-works in Glasgow are as well planned and efficiently equipped as any in the world. Referring to the water supply, the Lord Provost said that the Water Commission had a considerable strain put upon them by the great heat of last summer. The opening of the Duchray and Keltie section on June 30 enabled an additional supply of about 4½ million gallons per day to be brought into the city. This section extended to about 6¼ miles; and it cost £200,000. The additional supply prevented any undue scarcity, although the quantity of water per head used in Glasgow was very greatly in excèss of that consumed in any other city in the kingdom. The Blackrig section of the new works, extending to 3⅛ miles, had been let; and it would cost from £90,000 to £100,000. The laying of new 36-inch mains from Craigmaddie reservoir to the city had also been commenced; and this would cost from £80,000 to £90,000. About £10,000 had been expended in laying down larger mains for the supply of Govan and adjacent districts. The Water Commissioners had, in accordance with powers obtained in 1892, purchased ground at the corner of High Street and Rotten Row; and had started the erection upon it of hydraulic power works, for the purpose of supplying water under pressure for the working of hoists and motive power generally. The building was to be of an ornamental character; and the whole works, including pipes in the streets, were estimated to cost from £60,000 to £70,000.

The Falkirk gas agitation proceeds apace. On Monday night the ratepayers of one of the wards of the town met and considered the situation in which the community are placed by the opposing Bills of which notice has been given. It is to the credit of the community of Falkirk that there were no violent remarks, or statements indicating a desire to squeeze the Gas Company upon terms. Councillor Storey, in a moderate speech, said that prices were being freely mentioned, and that they varied from £50,000 to £102,000. He thought that £40,000 would be a suitable figure; and that the difference would justify them going to Parliament. He, however, favoured a voluntary bargain. The meeting was altogether in favour of the transfer being accomplished. The Chairman of the meeting cited the case of Alloa, where the Corporation own the gas-works, and where, with gas at 3s. 4d. per 1000 cubic feet, the surplus last year was £802. In Falkirk, the Gas Company charged 4s. 2d. per 1000 cubic feet; and their profits must therefore be large. Of course, this was only a random assumption. No one seemed to know much about the affairs of the Gas Company. Even Bailie Weir, who is a shareholder, could not tell them what was the par value of the stock; all he knew was that he paid £2 12s. each for his shares. Someone said the shares were originally £1 each; and when questioned as to why the stock was increased, Bailie Weir (I think injudiciously) said he supposed it was done rather than raise the dividend. The Directors of the Gas Company have not yet indicated upon what terms they are prepared to dispose of their undertaking. A Committee of the Stirling County Council have considered the position they are in; and as a portion of the area of supply is in the county, they have resolved to recommend that both Bills be opposed, so as to get protection for consumers in the county districts. This has raised a question of some importance—viz., whether, if the Corporation acquire the undertaking, and they should be convinced of the necessity for extending the gas-works, they should not, in order to avoid such outlay, cut off the supply to the outlying districts, and so make the gas-works serve only the burgh, which they would be equal to doing for a number of years. I should say that, if that notion were entertained by the Town Council, there could be no better argument in favour of the Gas Company getting their Bill. A Parliamentary Committee, I suppose, would not favour a restriction of the gas supply by the Corporation, if a Company were prepared to give a full supply.

At the Dundee Gas Commission on Wednesday, there was some talk about the Bill which the Town Council are promoting for the amalgamation of the various public boards with the Council. Lord Provost Low said that times changed; and the spirit of the age was obviously coming to be favourable to the management of the business of public boards by representatives directly appointed by the ratepayers. He trusted the contemplated change would be brought about without the engendering of any ill-feeling, either in the Gas Commission itself, or in any of the constituencies represented in it. He gave notice that at the next meeting he would propose that the Commission should join with the Town Council in promoting the Bill.

The strike of miners in Scotland is practically over. It lasted for three weeks; but it was at no time general, and, indeed, was all along of a straggling nature. Desperate efforts were made in the beginning of the week to extend the area of disaffection from the west to the other parts of Scotland; but they failed. In the Lothians, the coal-owners granted an advance of 1s. per day, which the men agreed to accept, and remained at work. In Fifeshire, the leader of the men (Mr. John Weir, of Dunfermline) declined to advise his men to come out; and they, too, continued to work. Of course, there was a good demand for their coal; and they had the benefit of that. Although they refused to strike, the Fifeshire men are at present agitating for an increase of 12½ per cent. in their wages. Had they joined the strike, it would probably have been more protracted, as they have funds, which would then have been available for the whole of the men out. In the West, the men's organizations are impecunious, and not very complete. In fact, one reason why Mr. Weir declined to strike was that it was on account of the want of organization in the west of Scotland, and the men working long hours, that the price of coal was brought down, which led to the strike in England. This is a new theory; and I suppose it is partially correct. From the first the strike had not a chance of succeeding. A demand of 1s. per day, at a time when it was next to a certainty that coal will, in a few weeks, be selling at rates as low as, if not lower than, last summers' prices was sure to fail. That it should have been made was due, not to the action of the men but to their leaders, and particularly Mr. Chisholm Robertson, who is probably a little envious of the position which the leaders in England attained in being taken into consultation by Lord Rosebery. Mr. Robertson deftly attempted to get Government intervention; but he did not succeed in drawing Her Majesty's Ministers. With the failure to get the Government to move, and the want of support from outside, it was only a question of time for the strike to collapse. During the whole of this week, pit after pit has been opened; but the leaders, as is always the case, kept up the game of bluster to the end. Down to yesterday mass meetings were held, at which resolutions were unanimously passed to continue the strike; while this morning ever so many of the men went to work. This seems to indicate once again that a mass meeting is a very poor method for giving expression to public opinion. To-day the delegates, as the leaders call themselves, met in Glasgow, in private, and resolved that the men should resume work on Monday at the old rate of wages, in terms of the masters' offer to give the old wages till Feb. 1. Now that it is over, and the men's funds are exhausted, there is likely soon to be a movement to reduce wages, which the men will be powerless to resist.

Glasgow has not, very fortunately, suffered so much from the miners' strike as was thought a week ago. At a meeting of the Town Council on Thursday, the question was asked whether there was any truth in the statement that the stock of coal on hand was only sufficient to last for a week. Mr. Ure, the Convener of the Gas Committee, said it was quite erroneous. There was no doubt at all that the unfortunate strike in the coal trade had caused the Gas Committee very great anxiety, and also some difficulty and expense; but there had never been the slightest fear that the department would not be able to meet the full requirements of the city as regarded its gas supply. The difficulty of the Committee had been more a question of price than of supply of coal. The citizens might take it from him that they were pretty safe against any likelihood of the city being put in darkness owing to the strike. The statement which is now said to be erroneous was issued with all the semblance of authority; but it is satisfactory to learn that the situation was not so alarming as it was made to appear. At the Council meeting, the minutes of the Gas Committee, which were submitted, stated that a correspondence had passed between Mr. Foulis and certain of the contractors for coal, with reference to short deliveries at the end of last month; and that the Committee had advertised for 20,000 tons of coal, to be delivered before Dec. 31. The Committee accepted tenders for the 20,000 tons; and instructed that the contractors who were behind with their deliveries should be informed of the particular quantities of the new purchases which had been allocated to them, and that the Corporation held them responsible for payment of the increased price they were paying, in terms of their contracts. This is quite right. The strike not having succeeded in raising the price of coal—or rather there being every probability that coal will be quite as cheap during the remainder of the year as it was at the date of the contracts—it is likely that no attempts will be made to break contracts anywhere. The operation of strike clauses in contracts will doubtless cause some inconvenience and expense; but it will be a satisfaction to communities if the low prices at which coal was bought last summer can be maintained.

The Hamilton Town Council, sitting as the Gas Commissioners, on Thursday night had before them a good-natured grumble by one of the members, with reference to the purchase of 180 tons of coal by the Convener of the Gas Committee without the knowledge of the Committee. The Convener (Mr. Brown) explained that the coal was purchased on the advice of the Manager; and that it was necessitated by the strike of miners. They bought it, he said, at 28s. per ton, which was the summer price; and he thought the best was done in the interests of the Corporation. I should say it was far better that, in a time when coal was scarcely to be had, when an opportunity occurred for purchasing, it should be taken advantage of promptly, before someone else snapped at the offer.

Hitherto not much has been heard of the effect of the past dry summer upon the water supply of Edinburgh and Leith; but it is now announced that the supply has been seriously affected. The water in store is just now 1,693,794,000 gallons, as against 2,288,777,000 gallons at the same date last year. Two reservoirs which supply compensation water are practically empty; and when they fail, the compensation water—about half a million gallons per day—will require to be taken from the spring water, which will still further cripple the supply to the community. The western and the higher districts of Edinburgh are already suffering from want of water. To relieve the south and west districts, the Water Trust are at present laying a 12-inch main from Alnwickhill; but even when it is completed, it is questionable whether there will be filtering capacity at Alnwickhill to meet the demand which will then be made upon it. Copious rains, which may be expected soon, would, of course, relieve the situation.

Reduction in the Price of Gas at Colne.—The Colne Local Board have resolved to revert, from the 1st of January next, to the charge of 3s. per 1000 cubic feet of gas. It may be remembered that, in consequence of the advance in the cost of coal, they recently raised the price to 3s. 6d.

A New Use for the Bicycle.—It is stated that the latest innovation in the utilization of bicycles is to be seen in Paris, where they are used by the lamplighters when going their rounds. They are found to be of special service in the suburbs and on the outer boulevards, where the men have long distances to cover. The plan has, we believe, answered very well; the work being more expeditiously performed.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 9.

Sulphate of Ammonia.—There has been a large demand for spot parcels during the week; and all lots offering have been taken readily off the market—the difficulties of deliveries in the North having added considerable strength to the English markets; and, unless the miners give in at an early date, the position will presently become a very tight one. During the past few days, £13 15s. has been generally realized; and to-day £13 17s. 6d. to £14 is quoted. Second-hand parcels have, in view of the advance in prices, more or less entirely disappeared as far as the December delivery is concerned; but speculators seem undeterred as regards spring deliveries, which they are offering on the basis of present values. Meanwhile £13 15s. has been refused by makers for January-April delivery; and there are apparently still buyers at £13 10s. for May-September delivery. Nitrate is steady and unchanged.

LONDON, *Dec.* 9.

Tar Products.—There is a revival in the demand for carbolic acid; and a considerable business has been done, for a few months of next year, at the prices quoted below. Benzol, particularly 90 per cent., is extremely sick, and can only be sold when in conjunction with 50's. Common creosote oils are firm; stocks having been denuded by the coal strike, There is an excellent demand for solvent naphtha; but the price does not improve. Anthracene is distinctly firmer; and the Tar Products Sales Committee are to be congratulated on having maintained its value now for upwards of twelve months. Prices may be taken as follows: Tar, 15s. 6d. to 16s. 6d. Pitch, 26s. 6d. to 28s. Benzol, 90's, 1s. 5d.; 50's, 1s. 6d. Creosote, 2d. Creosote salts, 25s. Solvent naphtha, 1s. 5d. Toluol, 1s. 8d. Crude benzol naphtha, 30 per cent., 8½d. Carbolic acid, 60's, 1s. 7d.; crystals, 6d. Cresol, 1s. 4d. Anthracene, 30 per cent., "A," 1s. 2d.; B," 10d.

Sulphate of Ammonia.—There is a distinctly firmer market, with a large inquiry, both for spot and forward delivery. Large business has been done, at prices ranging between £13 10s. and £13 17s. 6d., less 3½ per cent., with a prospect of even higher prices before many days are over. Gas liquor is quoted at from 8s. 6d. to 9s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—For all descriptions of fuel, there is a fairly active demand generally, which is taking away the present output of the collieries; and it is very exceptional where anything at all is going into stock, except perhaps in some of the inferior sorts of fuel. Round coals remain steady at the rates fixed last week. At the pit mouth, prices average about 14s. for best Wigan Arley coals; 13s. to 13s. 6d. for seconds Arley and Pemberton four-feet; 11s. 6d. to 12s. for common house-fire coals; 10s. to 11s. for steam and forge coals; 8s. to 8s. 6d. for burgy; and 6s. 6d. to 7s. 3d. for the best qualities of slack. For the very inferior descriptions of slack, however, there is a giving way in prices; and these might now be bought at about 5s. up to 6s. per ton, according to quality. Generally there seems to be a likelihood of prices remaining steady for the next month or two, as, owing to the complete absence of stocks, there are not likely to be any excessive supplies offering in the market; and if there is any easing down, it will be chiefly in some of the common descriptions of fuel which under any circumstances do not find a ready sale. In the shipping trade, there is a good demand for steam coal; and ordinary common round coal from the Lancashire collieries is fetching about 12s. to 12s. 6d. per ton, delivered at the High Level, Liverpool, or the Garston Docks.

Northern Coal Trade.—The effect of the Midland strike on the coal trade of the North of England is now beginning to fall off, though there are still some contracts for coal that are running. These, and the quantities that have been sent to Scotland, have given continued activity to the trade; and prices have been higher than they fell to after the end of the Midland miners' strike. Best Northumbrian steam coal has been in strong demand, and commanded at one time since our last report as high as 16s. per ton; but it is now about 14s. 6d. per ton. Small steam coal is rather more abundant; and may be quoted at about 6s. to 6s. 6d. per ton f.o.b. In gas coal, there is a very strong demand; and some of the producers cannot meet their contracts. For odd and uncontracted cargoes, the price quoted here varies from 10s. to 11s. per ton f.o.b.; but it is quite likely that there may be rather lower figures taken for forward rates. The contracts for the supply of the largest local gas company are now in the market; and there is considerable speculation as to the rate that will be paid. It is stated that the cost under the contracts that expire with the year is about 6s. 9d. per ton, on the average; but it is tolerably certain that much higher prices will rule for the next year, because the current contracts have not been remunerative, and because it is believed that the tendency in prices will be upwards through higher wages. Manufacturing coals are also steady; and contracts are being entered into at slightly better rates. Coke is very firm; the demand locally being very large, though the exports have been limited of late. There is no alteration in the price of gas coke this week.

Scotch Coal Trade.—The coal trade in Scotland was terribly dislocated last week by the strike. As it is now at an end, the condition of things will, it is expected, return to something like what it was in the early part of the year. There has been a great demand for Fife and Lothian coal; and in those districts stocks have been cleared out. In the West, where the strike existed, a good many of the men started work during the past week, before the formal termination of the strike, which was agreed to in Glasgow last Saturday; and their action led to the market being better supplied, to works being re-started, and to a decrease in the demand for Fife and east country coal. At the same time prices declined rapidly. Quotations cannot yet be given; but, taken generally, the price in the past week dropped from about 25s. to 12s. per ton. The shipment figures have now come in; and they show a great falling off. For the week they amounted to 85,455 tons—a decrease upon the figures for the previous week of 85,624 tons, and for the corresponding week of last year of 55,576 tons. For the year to date, the total shipments have been 7,247,450 tons—an increase, as compared with the same period of last year, of 87,669 tons.

Unfounded Charge of Theft against a Meter Inspector.—At the Sheriff's Court, Red Lion Square, last Friday, the case *M'Hugo v. Millins and Wife*, an action for slander, which had been remitted from the High Court for the assessment of damages, was heard. The plaintiff was in the employment of the South Metropolitan Gas Company. The defendants were tripe dressers, of Greenwich; and they had publicly stated that, while the plaintiff was taking the register of the gas-meter at their place of business, he had abstracted 8s. from the till. The plaintiff utterly denied the allegation. The Under-Sheriff suggested that nominal damages should be given; and he proposed 40s. The defendant, who appeared in person, refused to apologize; and the jury assessed the damages at £10.

The Filtration of the Rotherham Corporation Water Supply.—At the meeting of the Rotherham Town Council last Wednesday, a report was submitted by the Water Committee with reference to the supply of water from the Wellgate Spring, the use of which Dr. Thomson, one of the Medical Officers of the Local Government Board, after an inquiry some time ago as to an outbreak of cholera, advised should be discontinued. This created a great scare in the district; but the Corporation have been compelled to have recourse to this source, or otherwise the Ulley reservoir would now be practically dry. The Committee stated that a new light had been thrown upon the subject of the filtration of water by the report of the Royal Commission on the Metropolitan Water Supply; and their Engineer (Mr. Newton) was prepared to submit a scheme by which the effectual filtration of the Wellgate spring water could be carried out. It was recommended that this remedy should be applied; and the proposal was agreed to.

The Electric Lighting Scheme for Coventry.—The Coventry City Council last Tuesday adopted a report of the Electric Lighting Committee, from which it appeared that they had been advised by Mr. A. H. Preece, of Westminster, to accept a tender submitted by Messrs. John Fowler and Co., of Leeds, with Mr. Robert Hammond as Consulting Engineer, for the erection of the proposed electric lighting works. The amount of the tender as it stands is £8843; and to this will have to be added the cost of trenching the streets, and of a small plant of 15 kilowatt capacity, which Mr. Preece recommends should be added to the station for the purpose of supplying current at times of light load—amounting to a further £1000. Beyond this the purchase-money of the site, the cost of the buildings, and the wages of the clerk of the works will have to be provided for. While not anticipating that the estimate of £15,000 will be exceeded, the Committee recommended that application should be made to the Local Government Board for their sanction to a loan of £20,000.

Increases in the Price of Gas.—As will be seen elsewhere in the present issue, resolutions to advance the price of gas were passed last week by the Birmingham and Leeds City Councils. In addition, the Halifax Corporation last Wednesday, by 24 votes to 22, agreed to a recommendation of the Gas Committee that the price should be raised by 3d. per 1000 cubic feet from the 25th inst. At Burnley, on the same day, the recommendation of the Gas Committee to advance the price by 3d. and 4d. per 1000 cubic feet, to which reference was made in the JOURNAL for the 21st ult., was agreed to by the Council. At Darwen the new year will open with an advance of 3d., and at Stalybridge, one of 6d. per 1000 cubic feet. At Birkenhead, an increase from 3s. to 3s. 4d., with a rebate of 3d. per 1000 cubic feet as at present, will be in operation during the first half of next year. At the monthly meeting of the Lytham Improvement Commissioners last Thursday, it was decided that the price of gas should be advanced 4d. per 1000 cubic feet until the end of the financial year. The price will now be 3s. 8d.

The Strinesdale Reservoirs of the Oldham Corporation.—The Oldham Corporation Water Committee recently held a special meeting to consider a resolution of which Mr. S. Dodd had given notice, suggesting the appointment of a Sub-Committee to inquire and report as to the best means of dealing with the water of the Strinesdale reservoirs. In the course of his remarks, he said it was not necessary this should be an expensive affair, seeing they had the advantage of the services of Mr. G. H. Hill, as Consulting Engineer; and he would be able to tell them in what way the filtration systems of which he was cognizant could be applied to Strinesdale. The area of the Upper Strinesdale reservoir was 12 acres, and of the Lower Strinesdale reservoir 16 acres; the drainage area was 660 acres; and the compensation was only 3 million gallons per annum. Comparing this with Piethorne, Hanging Lees, and Norman Hill, those together had a total area of 53 acres and a drainage of 1292 acres, or double that of Strinesdale; but the yearly compensation was the enormous quantity of 420 million gallons. At Denshaw, they had a reservoir area of 49 acres, and a drainage area of 1437 acres—rather more than double that of Strinesdale—but the yearly compensation was no less than 327 million gallons, against 6 million gallons for Strinesdale. Taking 25 gallons per head of the population, Strinesdale supplied a population of 30,000; Piethorne, 51,000; and Denshaw, 58,000. Looking at the costs in the same way, they would find the comparison equally favourable to Strinesdale. Now they had four courses open to them: (1) They might allow the water to run to waste, but they would have the 4224 £1 annuities to pay, which was 4 per cent. on £105,600; (2) they could use the water as it was, and this they were afraid to do; (3) they could lay a network of pipes all over the borough, and supply the water for manufacturing purposes only; (4) they could adopt central filtration, and, if they did this, the water would be superior to any of their other supplies. Mr. Carson, while raising strong opposition to the Strinesdale water, seconded the motion, as he thought it right that Oldham should take part in finding out the best means of purification. After a long discussion, the resolution was carried

Holt (near Wrexham) Gas-Works.—These works, it is reported, are about to be transferred to a new Company; but Mr. John Hughes, who has been the Manager for the past 17 years, will continue to hold that position.

Grimsby Extension and Improvement Bill.—The Grimsby Town Council have determined to discontinue this year all proceedings in connection with the promotion of the Bill of which they had given notice, and which was referred to in our "Parliamentary Intelligence" last week. It is considered there are several things in the Bill that require modification; and these are to be further dealt with.

Meter-Rents and Gas Deposits.—An agitation has been set on foot at Colne against the meter-rent system and the payment of deposits by gas consumers. The Local Board have declined to abolish the deposits; and at their last meeting a request was preferred by the local Trades Council that they should pay interest on these funds, and also cease to charge rent for the meters. The Board referred the matter to a Committee; the Chairman remarking that they could not do anything during the present financial year.

Settlement of the Bilston Gas Company's Rating Appeal.—The appeal of the Bilston Gas Company against the poor-rate assessment made in May last by the Assessment Committee of the Dudley Union was again mentioned, last Friday morning, at the Staffordshire Adjourned Quarter Sessions, by Mr. Alfred Young. He stated that the suggestion of the Bench regarding negotiations for a settlement had been acted upon; the parties having come to the following terms: The assessment to be reduced from £630 to £550 rateable value; the appellants to pay the taxed costs and £50 over. An order to this effect was made.

Fulwood Water Supply.—As mentioned in the JOURNAL last week, the Fulwood Local Board have decided to promote a Bill in Parliament for power to improve their existing water supply. It was stated at a meeting of the Board last Thursday that they had been in negotiation with the Manchester Corporation respecting a supply from Thirlmere, but the cost was prohibitive. The Corporation wanted £646 per annum for a quantity not exceeding 50,000 gallons per day. The Board came to the conclusion that the interest on the expenditure on a new reservoir would not come to this; and in 60 years the works would be paid for.

Sales of Shares.—At the Mart, Tokenhouse Yard, last Wednesday, Messrs. Fox and Bousfield sold portions of original shares in the *New River Company*. One 120th part of an Adventurer's share realized £770; a similar fraction of a King's share sold for £740; and one 96th part of a King's share for £920. There were a number of similar lots; the prices obtained ranging from £88,000 to £92,400 per share. They also sold some *Stroud Water-Works* 4½ per cent. debentures (£100) at £89.——On the same occasion, Mr. Alfred Richards sold, by instructions of the Directors, 300 £10 shares in the *Lea Bridge District Gas Company*. They were put up in lots of ten, and were sold at the following prices per share: 120 at £13, 20 at £13 5s., 150 at £13 7s. 6d., and 10 at £13 10s. The total amount realized was £3960.——On the previous day, Messrs. J. and A. Bray sold at Hastings, 14 £25 shares in the *Hastings and St. Leonards Gas Company* at £66 and £66 2s. 6d. each; and 42 £20 shares at prices ranging from £40 to £40 7s. 6d. A number of shares in the *Hastings Electric Light Company* were also disposed of at £11 apiece.——At a sale at Brighton yesterday week, ordinary £5 shares in the *Henfield Gas Company* fetched £2 2s. 6d. each. ——Last Wednesday, £7000 of 4 per cent. preference stock in the *Fylde Water Company* was offered for sale. The stock was submitted in £10 lots, and realized £12 10s. to £12 17s. each.

City and Guilds of London Institute.—Sir R. E. Webster, Q.C., M.P., distributed last Wednesday, at the Goldsmiths' Hall, E.C., the prizes and certificates awarded to the successful students in connection with the City and Guilds of London Institute. The Lord Mayor (Alderman Tyler) presided. Sir W. Prideaux having read a report on the several branches of the Institute's work, Sir R. E. Webster distributed the prizes and certificates. Referring to the Institute's work, he said he could not help being struck with the fact that, whereas in 1879 there were examinations in seven subjects only, in 1893 there were examinations in no fewer than 55. During the past year, 22,621 students had availed themselves of the advantages of the Institute. They must all have been glad to learn that a substantial number of persons in India, New South Wales, and New Zealand had presented papers for examination. He was sure that, if the work of the Institute could be of service in spreading technical education amongst those who desired to improve themselves in the great dependencies of Her Majesty, it would be an immense incentive to those concerned to carry it on with increased energy. Addressing himself particularly to the students, he said he could impress nothing more useful upon their minds than that they should learn, while young, to concentrate their abilities and energies upon whatever subject was before them.

The Electric Lighting of the City Streets.—At the meeting of the Commissioners of Sewers last Tuesday, Mr. Burmester moved—"That the gas standards be removed from the streets now lighted by electricity, and that it be referred to the Streets Committee to carry this out." He said that this was the legitimate outcome of the recent report of the Engineer on electric lighting. The total number of hours during which the lamps were burning was 783,343; while the total number of lamp-hour failures was only 374. The percentage of failure in lamp-hours was thus 0·047, or what was equivalent to one hour's failure in every 1230 hours. He thought justice ought to be done to the Electric Light Company by giving them credit for the way in which they had lighted the streets. The total quantity of gas consumed on account of the failure of the electric light during the six months had cost the Commission 1s. 2d.; whereas the Engineer reported that the Commission were paying for the maintenance of the 1219 gas-lamps at the rate of £1182 per annum. Mr. Turner said the six months just passed constituted the best part of the year. They were coming to the worst period; and it was absolutely inadvisable to remove the lamps. If the light failed, the City would be in a dreadful state. The standards should, he said, be allowed to remain till the end of March; and he moved, as an amendment, that they should not be removed till March 31 next. This was negatived; and the motion was agreed to.

New Joint-Stock Companies.—The New Quay Gas Company, Limited, has been registered, with a capital of £10,500, in £1 shares, to enter into an agreement with Mr. W. Clark and others to light with gas the township of New Quay, Cornwall. The first Directors are Messrs. W. Clark, R. D. M. Littler, and A. Dougall.——The Smokeless Heat and Light Syndicate, Limited, has been formed, with a capital of £20,000, in £5 shares, to enter into an agreement with Mr. W. W. Hastings for the acquisition of certain patents and inventions, and to develop them.

Electric v. Oil and Gas Lighting for Public Conveyances.—At the Bow Street Police Court last Thursday week, Mr. Kingham, Secretary of the London General Omnibus Company, was summoned for allowing six omnibuses to be in a public thoroughfare after sunset without a light. Mr. Hicks, for the Company, stated that the vehicles complained of were fitted with the electric light, which answered admirably in the summer, but proved a failure in the winter. The difficulty had been caused by an insufficiency of batteries, which took about six or seven hours to charge. A new contract had been entered into; the contractors would supply spare batteries, and would be liable to heavy penalties if the light failed. Under these circumstances, he hoped the Magistrate would only impose a nominal fine. Sir John Bridge fined the Company 1s. and costs in respect of each of the six carriages.

The Progress of Electric Lighting at Bristol.—Bristol seems (says a local contemporary) to have made a record in the history of electric lighting. Something like 90 per cent. of the available power has been bespoken; and altogether the demand for private supplies has been most satisfactory. The Electrical Committee have decided to order another engine; and before long still another must be obtained, and then the full number of engines which the central station can accommodate will have been placed. For the present the Finance Committee have resolved not to light all the municipal offices by electricity; and this gives the Electrical Committee equal to 2000 incandescent lights available for private consumers. When the Exhibition is closed at the end of January, another 2000 lights will be at their disposal. In all, something like 14,000 incandescent lamps have been applied for; and as the nominal power of supply is equal to only 10,000, it will be seen that the Committee are soon likely to be supplying light up to the utmost limit of their capacity.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1078.)

Issue.	Share	When ex-Dividend.	Dividend or Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Oct.	10½	Alliance & Dublin 10 p. c.	10	16—17	−½	6 3 6
100,000	10	„	7⅞	Do. 7 p. c	10	11½—12½	..	6 0 0
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	102—104	..	4 16 2
100,000	20	31 May	8	Bahia, Limited	20	11—12	+½	13 6 8
200,000	5	15 Nov.	6½	Bombay, Limited	5	5—5½	−¼	5 18 2
40,000	5	„	6½	Do. New	4	3¾—4¼	..	6 2 6
380,000	Stck.	16 Aug.	11½	Brentford Consolidated	100	220—225	..	5 2 2
180,000	„	„	8½	Do. New	100	163—168	..	5 1 2
220,000	20	15 Sept	11½	Brighton & Hove Original	20	41—43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	102—105	..	4 15 3
320,000	20	29 Sept.	11½	British	20	42—44	..	5 4 7
50,000	10	31 Aug.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	„	8⅛	Do. 7 p. c.	10	15—16	..	5 6 3
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	5⅝—6½	..	3 1 6
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	98—101	..	5 18 10
150,000	20	13 July	8	Cagliari, Limited	20	27—28	..	5 14 3
550,000	Stck.	13 Oct.	12½	Commercial, Old Stock	100	244—249	..	5 0 4
165,000	„	„	9⅛	Do. New do.	100	187—192	..	4 19 0
160,762	„	15 June	4½	Do. 4½ p. c. Deb. do.	100	125—130	..	3 9 3
800,000	Stck.	15 June	13	Continental Union, Limited	100	230—235	..	5 10 7
200,000	„	„	10	Do. 7 p. c. Pref	100	193—198	..	5 1 0
535,000	Stck.	15 Sept.	5	Crystal Palace Ord. 5 p.c. Stk	100	100—105	..	4 15 3
486,090	10	28 July	10	European, Limited	10	22—23	+1	4 6 11
354,060	10	„	10	Do. Partly paid	7½	14½—15½	..	4 17 0
5,646,590	Stck.	16 Aug.	12	Gaslight & Coke, A, Ordinary	100	230—235	..	5 2 1
100,000	„	„	4	Do. B, 4 p. c. max.	100	97—102	..	3 18 5
665,000	„	„	10	Do. C, D, & E, 10 p.c. Pf.	100	275—280	+2	3 11 5
30,000	„	„	5	Do. F, 5 p. c. Prf.	100	125—135	..	3 14 1
60,000	„	„	7½	Do. G, 7½ p. c. do.	100	185—190	..	3 18 11
1,300,000	„	„	7	Do. H, 7 p. c. max	100	173—178	..	3 18 7
463,000	„	„	10	Do. J, 10 p. c. Prf.	100	270—275	..	3 12 9
476,000	„	„	6	Do. K, 6 p. c. Prf.	100	161—169	+2	3 11 0
1,061,150	„	15 June	4	Do. 4 p. c. Deb. Stk.	100	128—132	+1½	3 0 7
294,850	„	„	4½	Do. 4½ p. c. do.	100	132—137	..	3 5 8
908,000	„	„	6	Do. 6 p. c. do	100	177—182	..	3 5 11
3,800,000	Stck.	15 Nov.	12	Imperial Continental	100	215—220	..	5 9 1
75,000	5	15 June	6	Malta & Mediterranean, Ltd.	5	4¾—5¼	..	5 14 3
560,000	100	2 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	105—107	..	4 13 5
541,920	20	15 Nov.	5	Monte Video, Limited	20	12¼—13¼	..	7 8 2
150,000	5	30 Nov.	8	Oriental, Limited	5	6¾—7¼*	..	5 10 4
60,000	5	29 Sept.	7	Ottoman, Limited	5	4—4½	..	7 15 6
166,870	10	—	2	Pará Limited	10	1¼—1½	−¼	—
				People's Gas of Chicago—				
420,000	100	2 Nov.	6	1st Mtg. Bds.	100	98—102	..	5 17 8
500,000	100	1 Dec.	6	2nd Do.	100	96-100*	..	6 0 0
150,000	10	13 Oct.	5	San Paulo, Limited	10	8½—9½	..	5 5 3
500,000	Stck.	31 Aug.	15½	South Metropolitan, A Stock	100	304—309	..	5 0 4
1,350,000	„	„	12	Do. B do.	100	242—247	..	4 17 2
260,000	„	„	13	Do. C do.	100	252—257	−3	5 1 2
750,000	„	13 July	5	Do. 5 p. c. Deb. Stk.	100	148—152	..	3 5 9
60,000	Stck.	31 Aug.	11½	Tottenham & Edm'nton, "A"	100	210—215	..	5 7 0
				WATER COMPANIES.				
744,897	Stck.	29 June	10	Chelsea, Ordinary	100	270—275	..	3 12 9
1,720,252	Stck.	13 Oct.	8	East London, Ordinary	100	208—213	..	3 15 1
544,440	„	29 June	4½	Do. 4½ p. c. Deb. Stk.	100	140—143	..	3 2 11
700,000	50	15 June	8½	Grand Junction	50	110—115	..	3 13 11
708,000	Stck.	16 Aug.	11	Kent	100	285—290	..	3 15 10
1,043,800	100	29 June	9½	Lambeth, 10 p. c. max.	100	240—245	−2	3 17 7
406,200	100	„	7½	Do. 7½ p. c. max.	100	199—204	..	3 13 6
310,000	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	128—131	..	3 1 0
500,000	100	16 Aug.	12½	New River, New Shares	100	345—350	+8	3 9 3
1,000,000	Stck.	28 July	4	Do. 4 p. c. Deb. Stk	100	132—135	..	2 19 3
902,300	Stck.	15 June	6	S'thwk & V'xhall, 10 p. c. max.	100	155—160	..	3 15 0
126,500	100	„	6	Do. D 7½ p. c. do.	100	145—150	..	4 0 0
1,155,066	Stck.	15 June	10	West Middlesex	100	264—269	..	3 14 4

*Ex Div

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON."

GWYNNE & CO., TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

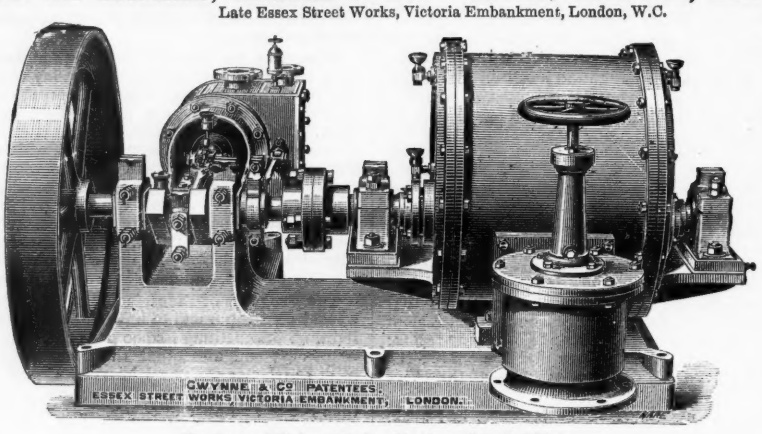
Late Essex Street Works, Victoria Embankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent.
Please address all communications to the Company, as above.

ANDREW STEPHENSON, Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.
City Address: 182, Gresham House, Old Broad Street, LONDON, E.C.

VOLCANIC Fire Cement (Winkelmann's)
Fire Resistance 4500° Fahr.
ANDREW STEPHENSON, Sole Agent, 182, Gresham House, Old Broad Street, LONDON, E.C.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH.
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, } SCOTLAND.
NEWTON GRANGE, NEAR DALKEITH, }

ALWAYS a Buyer of Spent Oxide, Tar, and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

WANTED, a Situation as Working Gas Manager, used to Engine and Exhauster. Can use all Tar made for firing Retorts, lay Mains and Services, fix Meters, take Indices, and do his own Mechanical Repairs upon the Works.
Address No. 2303, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A GENTLEMAN, with very valuable connection among Gas-Works in the North of England and Wales, requires a SITUATION. Particulars on application.
Address, in first instance, No. 2309, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, Two or Three Travellers with undoubted connections with Gas Companies. Say in what part of England connection exists, and Salary required.
Apply, by letter, stating experience and full particulars, to No. 2305, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a good Gas-Fitter, well up in all kinds of Fittings, either private or public. A permanent Situation to a steady Man.
Apply, as under, stating age and salary required, with copies of testimonials, to No. 2310, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. IV., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

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G. L. LAMBERT, 26, Alberta Terrace Nottingham. Consultations, Advice, Reports in Various Branches of **Practical** Mechanical Engineering and Machinery. **Specialities** in Water, Sewage, and Gas Plant Making. **Surveyor** of Steam-Ships, Marine Engines, Boilers, and General Machinery. **Detailed Inspection** of Engineering Contracts during Manufacturing and Erection.

WANTED, to hire, at once, one or more RAILWAY TANKS for carrying Vitriol.
Particulars, with charges, to JOHN NICHOLSON & SONS, Chemical Works, Hunslet, LEEDS.

WATER-WORKS.

THE Valuable Property and Undertaking of the GUERNSEY WATER-WORKS COMPANY, LIMITED, will shortly be offered FOR SALE. Further Particulars will be announced later.
J. D. A. NORRIS, Receiver, Manager, and Liquidator, Suffolk House, Laurence Pountney Hill, LONDON, E.C.

TO RETORT & FIRE-BRICK MANUFACTURERS.

THE Corporation of Bury are prepared to receive TENDERS for RETORTS, FIRE-BRICKS, and FIRE-CLAY required at their Gas-Works.
Forms of Tender may be obtained from Mr. W. H. S. Gendall, Gas Engineer, Gas-Works, Elton, Bury.
Tenders, sealed and endorsed "Tender for Retorts," &c., to be sent to me not later than Monday, the 25th day of December, 1893.

JOHN HASLAM,
Town Clerk.

Bury, Dec. 8, 1893.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore, Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

LIQUOR, Tar, and Spent Oxide wanted. BROTHERTON AND CO., Ammonia and Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

MOUNTAIN ASH LOCAL BOARD.

TAR AND LIQUOR.

THE Local Board invite Tenders for the surplus TAR and for the AMMONIACAL LIQUOR produced at their Gas-Works, Penrhiwceiber, for One Year ending Dec. 31, 1894.
For further Information, apply to Mr. John Williams, Surveyor, Town Hall, Mountain Ash.
Tenders to be endorsed "Tender for Tar" or "Tender for Ammoniacal Liquor," as the case may be, and sent to H. P. Linton, Esq., Town Hall, Mountain Ash, on or before One o'clock on Monday, the 1st day of January, 1894.
The Local Board do not bind themselves to accept the highest or any tender.

Now Ready, Cloth Bound, Price 3s. 6d., Post Free,

THE ROYAL COMMISSION on the METROPOLITAN WATER SUPPLY.

— 1892-3. —

Report of the Evidence (reprinted from the JOURNAL), with Comments on the Inquiry, and the Commissioners' Conclusions and Recommendations.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

BOROUGH OF BURTON-UPON-TRENT.

FIRE-CLAY GOODS.

THE Mayor, Aldermen, and Burgesses of the Borough of Burton-upon-Trent, acting by the Council, invite TENDERS for the supply of the FIRE-CLAY RETORTS, BRICKS, and CLAY required at the Gas-Works during the Year 1894.

Full Particulars of the Specification and Conditions, with Form of Tender, may be obtained on application to the undersigned, to whom sealed tenders, endorsed "Fire-Clay Goods," must be delivered on or before Saturday, the 23rd day of December inst.

The lowest or any tender will not necessarily be accepted.

F. L. RAMSDEN,
Manager and Engineer.

Gas-Works, Burton-upon-Trent,
Dec. 1, 1893.

WELLINGTON (SOMERSET) GAS AND COKE COMPANY.

TO GASHOLDER MAKERS.

THE Directors of the above Company invite TENDERS for the supply and erection of a SINGLE-LIFT GASHOLDER, 62 feet diameter by 18 feet deep, and CAST-IRON TANK for same, together with 9-inch Inlet and Outlet Pipes, Syphons, Valves, &c.

Contractors to furnish Plans and Specifications, and to state separately price for Holder and Connections, without Tank.

Tenders to be sent in not later than Jan. 1, 1894, addressed to the undersigned (of whom further particulars may be obtained), and endorsed "Tender for Gasholder."

The Directors will not bind themselves to accept the lowest or any tender.

(Signed) PHILIP THOMAS,
Manager.

Gas-Works, Wellington, Somerset,
Dec. 5, 1893.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is hereby given, that the TRANSFER BOOKS of this Company, so far as they relate to the Debenture Stock and Bonds, WILL BE CLOSED on the Evening of Thursday, the 14th of December inst., for the Half Year ending on the 31st of December, 1893, and that the Interest for that Half Year will be payable on the 1st day of January, 1894, to the Proprietors registered as the holders of such Debenture Stock and Bonds at the time of such closing of the Transfer Books, which will be re-opened for the following Half Year on the Morning of Tuesday, the 19th of December inst.

By order of the Board,
JAMES RANDALL,
Secretary.

Gas Offices, Willoughby Lane, Tottenham,
Dec. 8, 1893.

Price 2s. per dozen, or 10s. 6d. per 100, post free.

CONSPIRACY and Protection of Property Act. It is required, under a Penalty of FIVE POUNDS, that a Printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat.

Printed copies of this Section, in large type, on broad sheets, may be obtained of WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

*** *The Act extends to Scotland and Ireland.*

Now Ready, Price 15s., Limp Cloth, the Thirteenth Yearly

ANALYSIS OF THE ACCOUNTS

OF THE

Metropolitan Water Companies,

Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex—showing the Capital, Income, Expenditure, Profits, and Dividends per Million and per Thousand Gallons of Water supplied; the proportion of Expenditure and Profits to gross Income; and the Income, Expenditure, and Profits per House, &c., supplied for the year ended December 31, 1892, or March 31, 1893, together with the quantity of Water supplied, the estimated daily quantity supplied for domestic and other purposes, the quantity supplied per head of population, &c., &c., for the year ended December 31, 1892.

Compiled and arranged by

ALFRED LASS, F.C.A.

LONDON:

WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.,
B Lombard Street,
NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

SEAHAM HARBOUR, COUNTY OF DURHAM.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to

MR. MARK ARCHER,

HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY
FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.

London Office:

90, CANNON STREET, E.C.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The
WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.
Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**
The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

To effect a great saving in

GAS-FURNACES use our Special Derbyshire **GANNISTER BRICKS.**

ADDRESS

JAMES WHITE & Co., Limited,
ALBERT WORKS, WIDNES.

NIDDRIE CANNEL

A FIRST-CLASS CANNEL COAL,

Yielding a large volume of rich Gas, and fully 60 per cent. of first-class Coke.

FOR ANALYSIS, PRICE, AND ALL OTHER PARTICULARS, APPLY TO

The Niddrie & Benhar Coal Co., Ltd.,
15, HANOVER STREET,
EDINBURGH.

Telegrams: "BENHAR, Edinburgh."

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,
Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 22, Alwyne Road, Canonbury, LONDON, N.

Prices are Reduced.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

HUNTER'S

OXIDE OF IRON.

JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

11, BAY STREET, PORT GLASGOW.

Telegrams: "HUNTER PORT GLASGOW."

Established 1872.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

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Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
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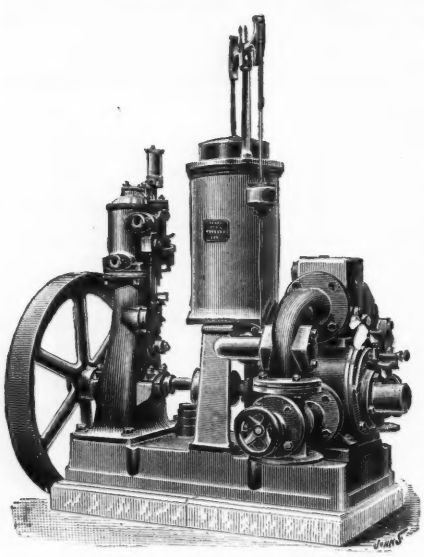

WALLER'S PATENT COMBINED GAS ENGINE AND EXHAUSTER

WITH

Disc-Valves, Automatic Bye-Pass Valve, Throttle-Valve, and Regulator,

COMPLETE ON ONE BASE PLATE.

Designed chiefly for sizes from 500 to 15,000 feet per hour.

CAN BE SEEN IN ACTION AT ADDRESS BELOW.

EXHAUSTERS OF ANY SIZE

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Price One Guinea.

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By E. H. STEVENSON and E. K. BURSTAL, MM.Inst.C.E.

The Work published in 1879 by the late Mr. Stevenson is still on sale.

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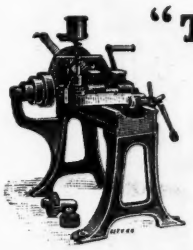

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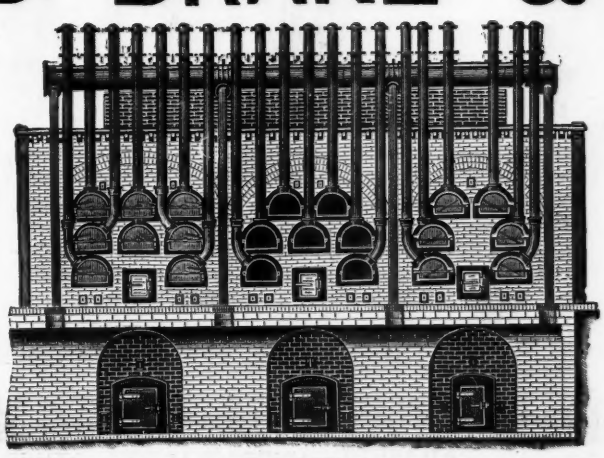

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CORPORATIONS AND COMPANIES ARE RESPECTFULLY INVITED TO SEND THEIR ENQUIRIES TO US.

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SOLE MAKERS OF WECK'S PATENT CENTRE-VALVES FOR PURIFIERS.

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Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS

Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

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General Superintendent & Chief Engineer,
The United Gas Improvement Company, U.S.A.

A. G. GLASGOW, M.E.,
Late General Inspector,
The United Gas Improvement Company, U.S.A.

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ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

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Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
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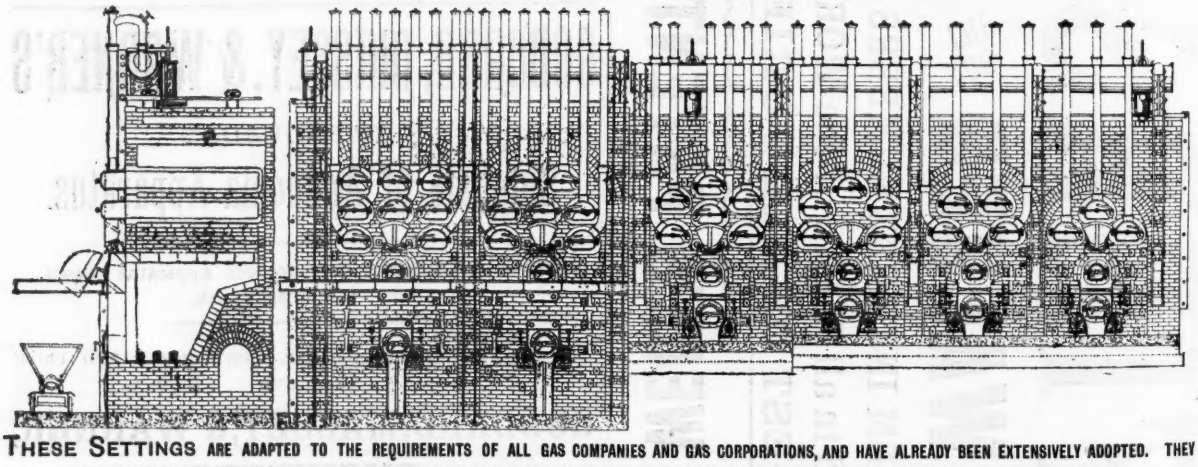
FOR THE ERECTION OF GAS AND WATER WORKS
COMPLETE, AND FOR EXTENSIONS AND RENEWALS.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stewart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge, and from R. F. HISLOP (son of Patentee), Gas-Works, Paisley.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

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FOR GAS, WATER, AND STEAM.
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OF SUPERIOR QUALITY
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GREATER DURABILITY
Strongly recommended where EXCESSIVE HEATS have to be maintained.

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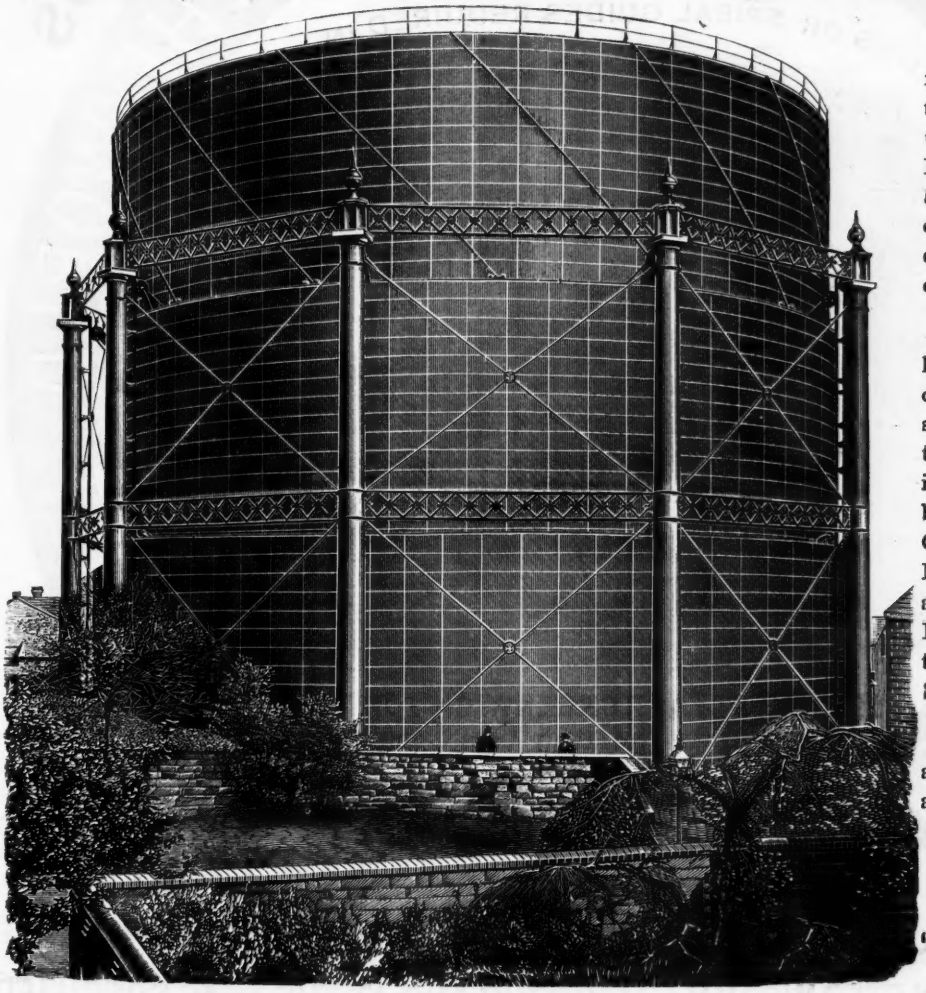
SOLE LICENSEES OF
SPIRAL GUIDED GASHOLDERS.



This illustration is taken from a photograph, showing the addition of a Third Lift to an ordinary Telescopic Holder, 102 ft. diameter by 56 ft. deep, which has been in constant use for upwards of eighteen months, and given entire satisfaction.

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THE LARGEST GASHOLDER IN THE WORLD.

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NO WIRE ROPES OR SPIRAL GUIDES REQUIRED IN THIS SYSTEM.

INFINITELY SAFER AND FAR LESS COSTLY

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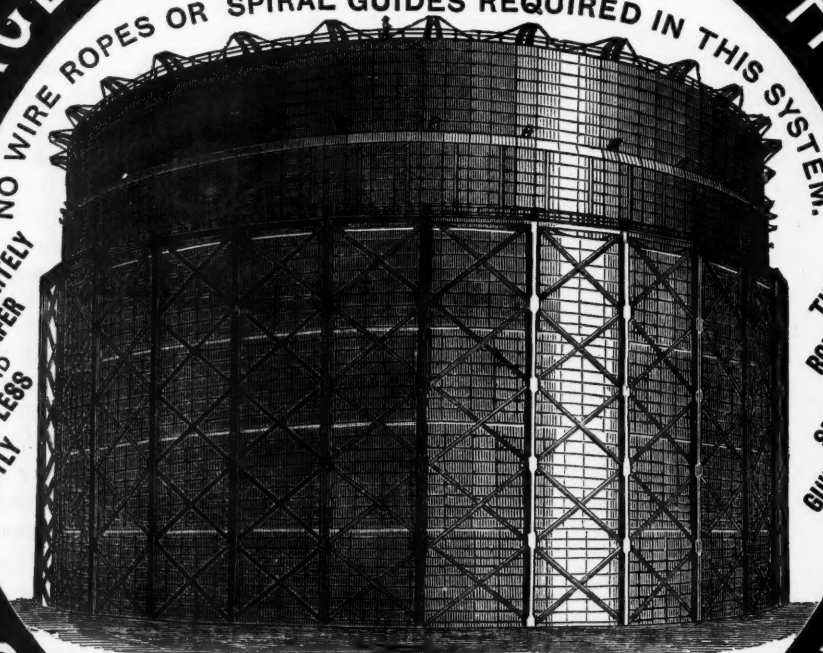

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MANUFACTURERS OF
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Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.
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ESTABLISHED 1836.

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Patent Automatic Machinery
FOR
DRAWING AND CHARGING
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Full Particulars may be obtained from the Sole Makers,
SIR WILLIAM ARROL & CO., Limited,
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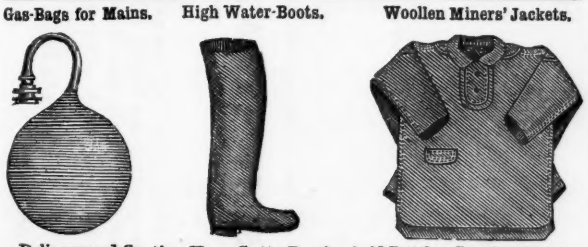
See Illustrated Advertisement, p. II. Centre of JOURNAL for Dec. 5.

Gas-Bags for Mains. High Water-Boots. Woollen Miners' Jackets.



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Write for Price List to
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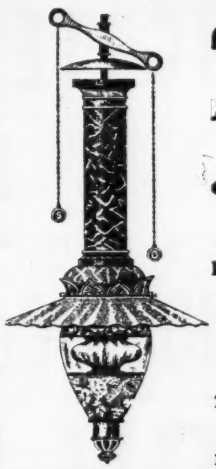
The Climax of Regenerative Gas Lighting!!



THE
"VERTMARCHE"
A 280-CANDLE POWER
PLAIN IRON LAMP,
CLASS A— 55/-
LIGHT for LIGHT
less than half the price of any other Regenerative Lamp.
Manufactured in England by
HENRY GREENE & SONS,
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PARTICULARS AND PRICES FREE. AGENTS WANTED.

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GAS & WATER ENGINEERS,
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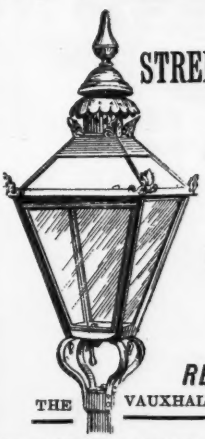
Manufacturers of
STREET LAMPS for HOME & EXPORT.



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HIGH-POWER LANTERNS FOR REFUGES & OPEN SPACES.

IMPROVED STREET-LAMP REGULATORS AND LAMP TAPS.

THE VAUXHALL.

FLAT-FLAME GOVERNOR BURNERS,
Suitable for FACTORIES, OFFICES, and all Open Lights.
at 12/- per dozen.

PATENT LAMPLIGHTERS' TORCHES.

COLUMNS for GAS or ELECTRIC LIGHTING.

Works: 18, STEPHEN STREET, TOTTENHAM COURT ROAD, W.

IMPORTANT TO ENGINEERS AND GAS COMPANIES.

A NEW CARBURETTOR FOR ENRICHING GAS IN BULK.

The Carburettors have been doing practical work for the past two years; in many cases doing all the enrichment without the use of Cannel or other rich Coals. The South Metropolitan Gas Company have these Enrichers at all their Stations. The Gaslight and Coke Company have had them in use at some of their principal Works for two years past; and several more are now being fixed at their other Stations. The Carburettors are also in use at several Suburban and Provincial Gas Companies' Works.

FOR PRICES AND FULL PARTICULARS, APPLY TO

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,
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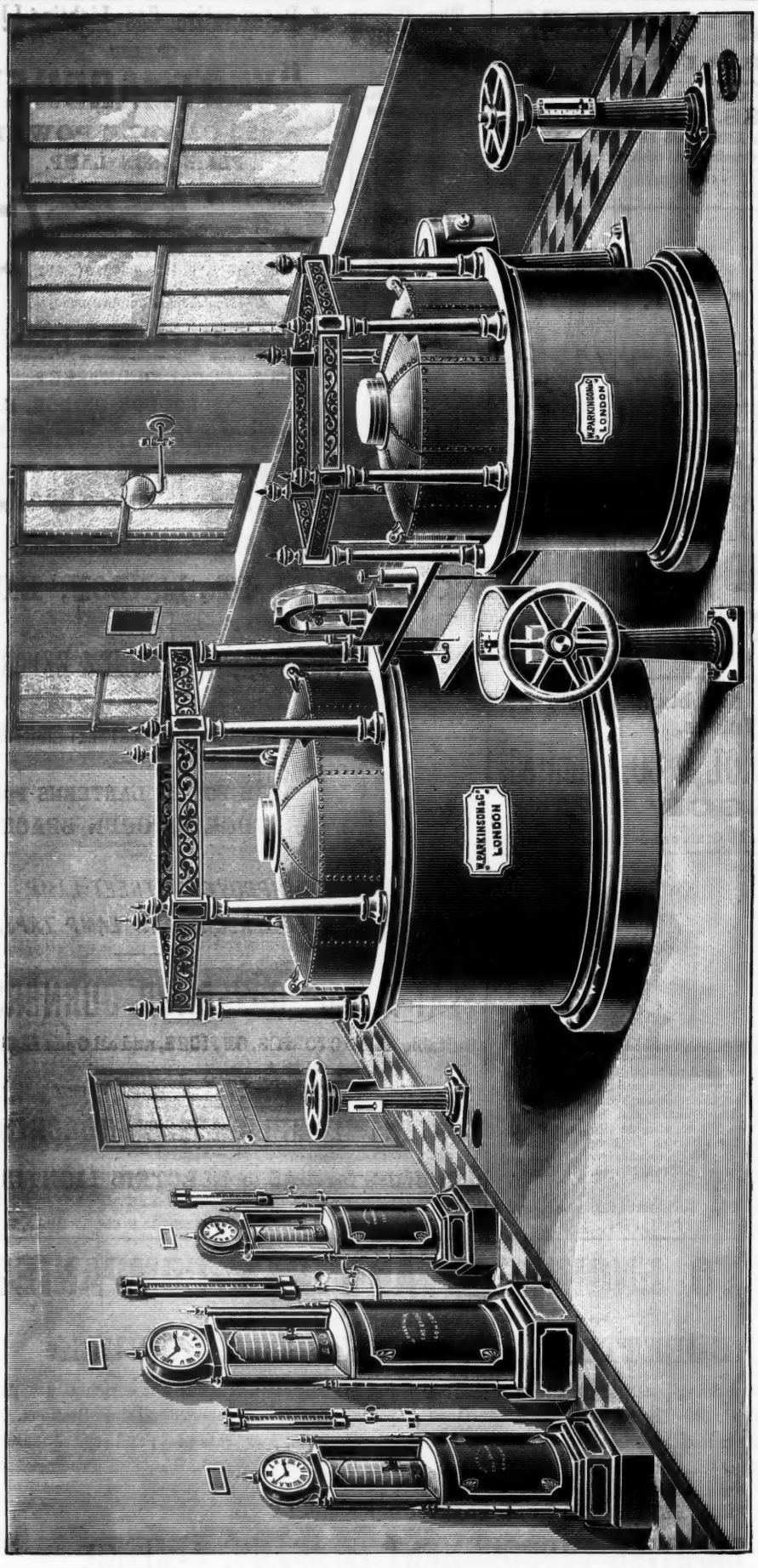

EQUILIBRIUM GOVERNORS, THE GASLIGHT AND COKE COMPANY'S VALVE-ROOM, STOKE NEWINGTON.

(TESTIMONIAL.)

THE GASLIGHT AND COKE COMPANY, 146, *Goswell Road, E.C., Jan.* 5, 1893.

GENTLEMEN,—In reply to your inquiry as to the working of the 36-inch and 24-inch Governors (double cone and equilibrium) recently erected by you at the new Valve-Station of this Company, situated at Stoke Newington, I beg to inform you they are highly satisfactory in their working.

The gas governed is supplied through a high-pressure pumping-main; and, notwithstanding the great fluctuations in the initial pressure, owing to so many stations pumping and shutting off alternately, the construction of your Governors enables a perfect equilibrium to be maintained, and being acted upon themselves by outlet pressure only, they stand the most severe tests to perfection.

I shall be happy to answer any questions, or show the Governors to Engineers contemplating their erection.

I am, Gentlemen, Yours faithfully,
(Signed) G. F. L. FOULGER, Distributing Engineer.

Messrs. W. PARKINSON AND Co.,
Cottage Lane, City Road, E.C.

W. PARKINSON & CO., LONDON, BIRMINGHAM, MANCHESTER.

(See also Advt. p. 1074.

London: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Dec. 12, 1893.